BUYER'S GUIDE

FREIGHT ELEVATORS

WESTINGHOUSE

ELEVATOR DIVISION

Since Freight Elevators form an integral part of any material-handling system, the information contained in this publication has been prepared to serve as a guide to those concerned with the efficient transportation of material in industrial plants, warehouses, stores, or any multi-storied building. This information will assist architects, consulting engineers and building managements in the preparation of their plans for freight elevators.

Copies of the following Westinghouse publications may be obtained by writing on your letterhead to Westinghouse Electric Corporation, Elevator Division, Jersey City 4, New Jersey.

BUYER'S GUIDE, *PASSENGER ELEVATORS* (B-4572B) • BUYER'S GUIDE, *ELECTRIC STAIRWAYS* (B-4582C) WESTINGHOUSE BALANCED *VERTICAL TRANSPORTATION* (B-4586) • WIDENING FIELD OF *MOVING STAIRWAYS* (B-5265) • WESTINGHOUSE SELECTOMATIC (B-5274)

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ELEVATOR DIVISION
Westinghouse Electric Corporation
Jersey City 4, New Jersey

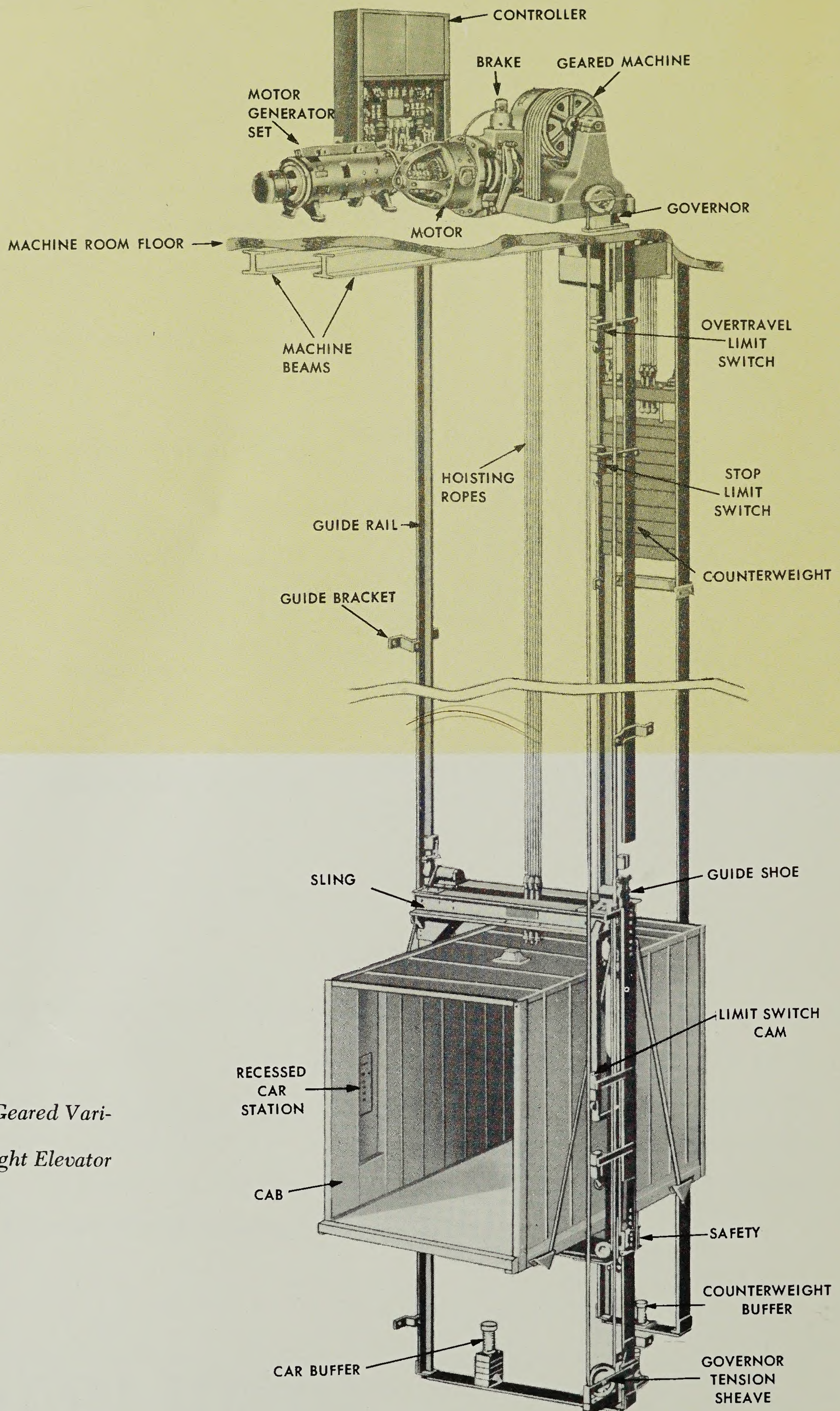


Figure 1. Typical Worm-Geared Variable Voltage Traction Freight Elevator

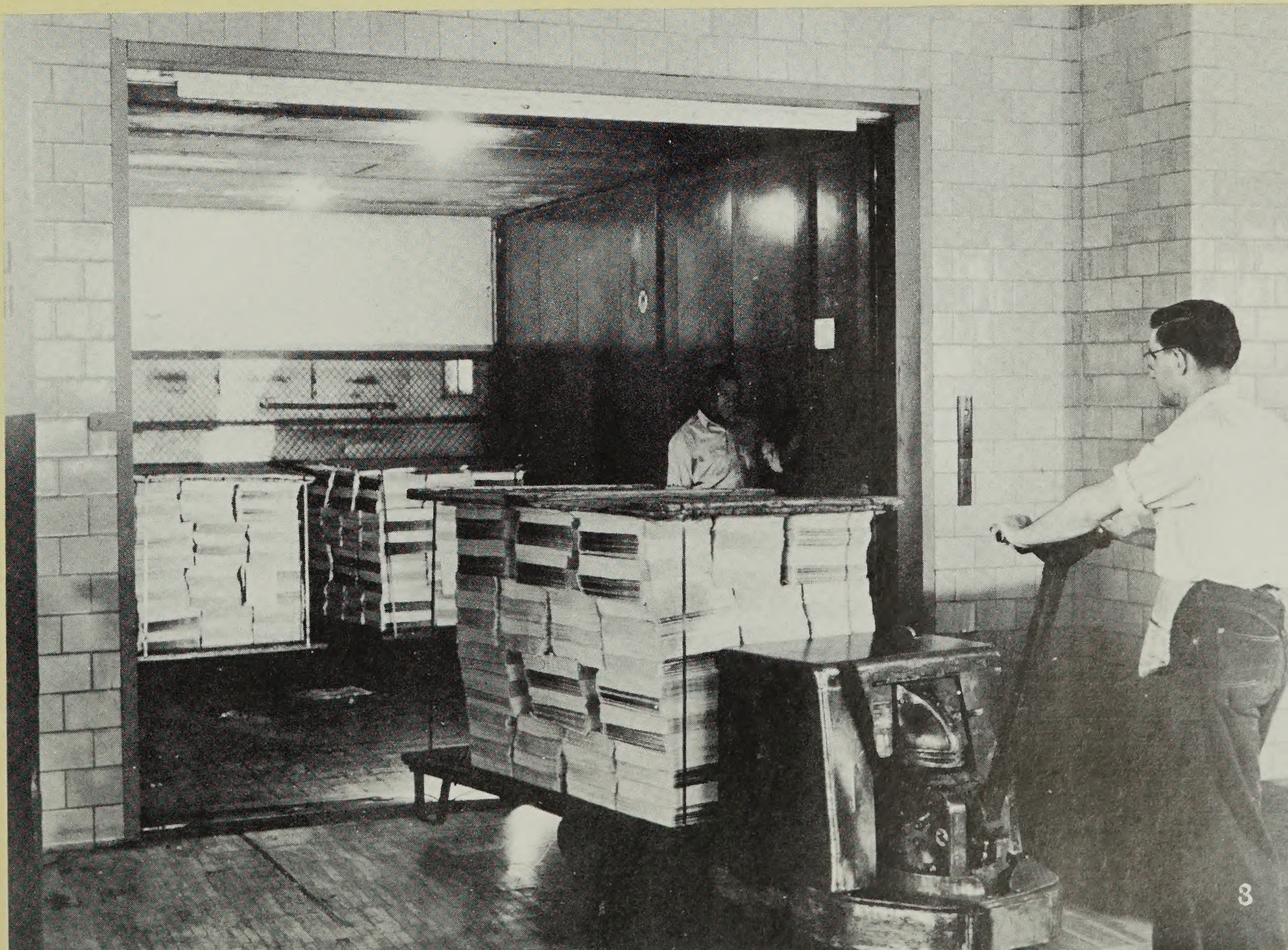
Introduction

A. GENERAL *(figures 2 and 3).*

Freight elevators form a vital part of the material-handling system in multi-floor factories, warehouses, garages, stores and other types of buildings. They carry raw materials, semi-finished parts, and finished products and materials of all descriptions from floor to floor. Each freight elevator installation usually involves a special engineering study. Westinghouse has a wide range of capacities, car speeds, platform sizes and controls which will satisfy the freight elevator requirements of any building, large or small.

The selection of a freight elevator must be based upon careful study and precise engineering since it is of major importance to the specific material-flow demands of individual buildings and industries. Westinghouse freight elevators are engineered, manufactured and installed with particular consideration for safety, economy and reliable operation.

Figure 2. Typical Westinghouse Freight Elevator in Use (Hand Operated, Power Truck Loading)



B. SELECTING THE PROPER FREIGHT ELEVATOR

No well defined cycle of operation exists for freight elevators; the uses to which they are put vary over a wide range. The selection, therefore, of the proper freight elevator becomes a matter of utmost importance. The selection should be based on a careful analysis of the actual cycle of operation required and should consider the immediate and also the probable future requirements. Particular consideration must be given to the use of power trucks for placing skidded or palletized materials on the car because of the great strain imposed on the entire elevator car structure and guide rails.

In the following sections is information intended to offer a few methods which have been found generally satisfactory in the application of standard freight elevators for general use.

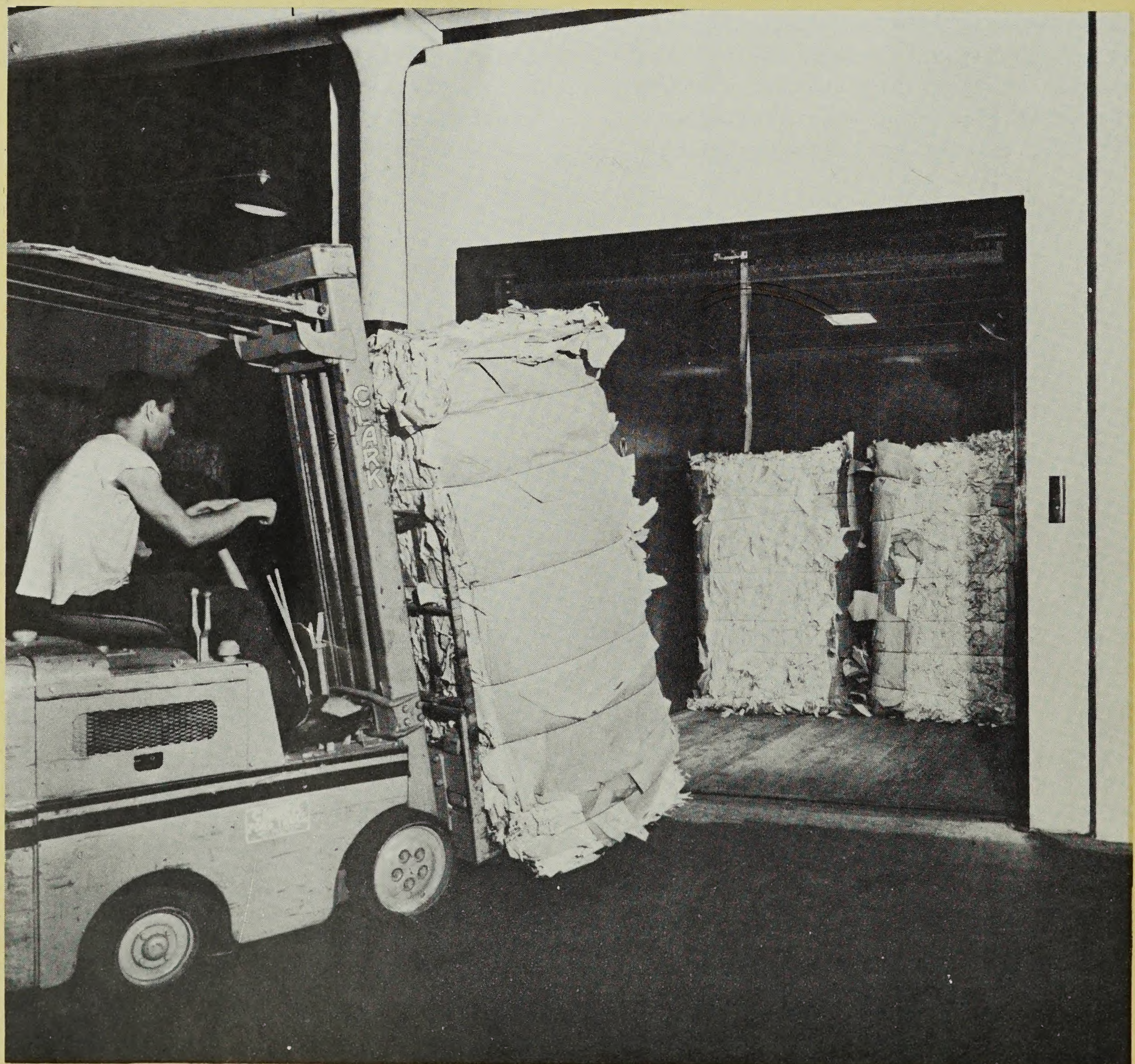


Figure 3. Typical Westinghouse Freight Elevator in Use (Power Truck Loading)

Types and Component Parts

A. GENERAL

All modern freight elevators are the traction type incorporating multiple hoist ropes which pass over a driving sheave on the machine. (Figure 4.) The geared type elevator machine is used for speeds of 200 feet per minute or less. For speeds above 200 feet per minute (unusual), gearless type machines are employed.

B. BASIC CONTROL SYSTEMS

Two general systems of control are used with Westinghouse freight elevators: The Variable Voltage system and the A-C Rheostatic system. Certain refinements of supervisory control can be added.

***1. The Variable Voltage system** (figure 5)* is the more flexible and to be preferred. The hoisting motor is direct current, and a motor generator set is provided for each elevator to furnish d-c power and to control speed and direction of motion of the car. Variable Voltage control eliminates rheostatic losses and allows accurate regulation and control of the leveling speed. It permits accurate stops and rapid acceleration and deceleration, thereby providing faster service. It requires minimum power consumption and maintenance. Automatic leveling is always furnished with Variable Voltage control to compensate for cable stretch or other variations from floor level. Having the elevator platform always flush at the landing being served is, of course, desirable for any type of load or method of loading, but a smooth threshold joint is necessary where relatively

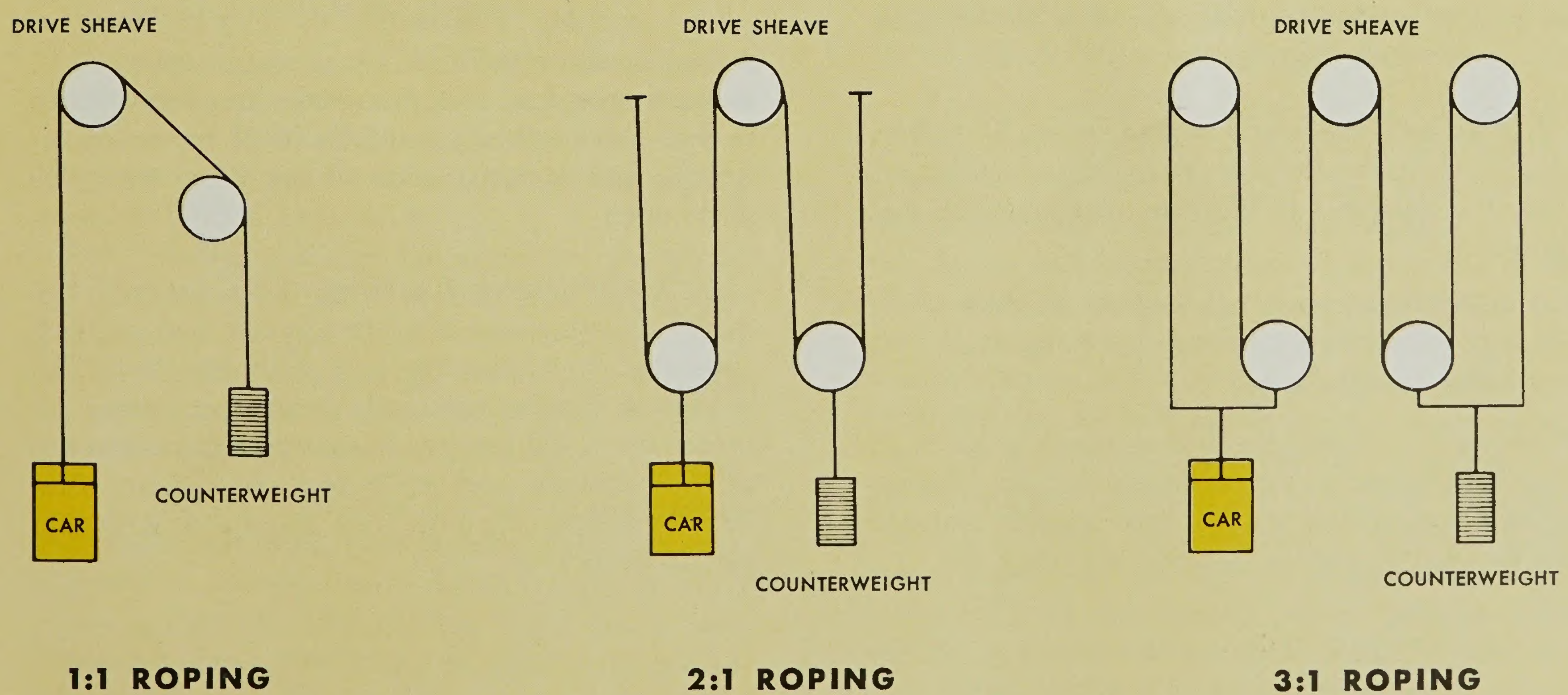


Figure 4. Schematic of Traction Type Elevators

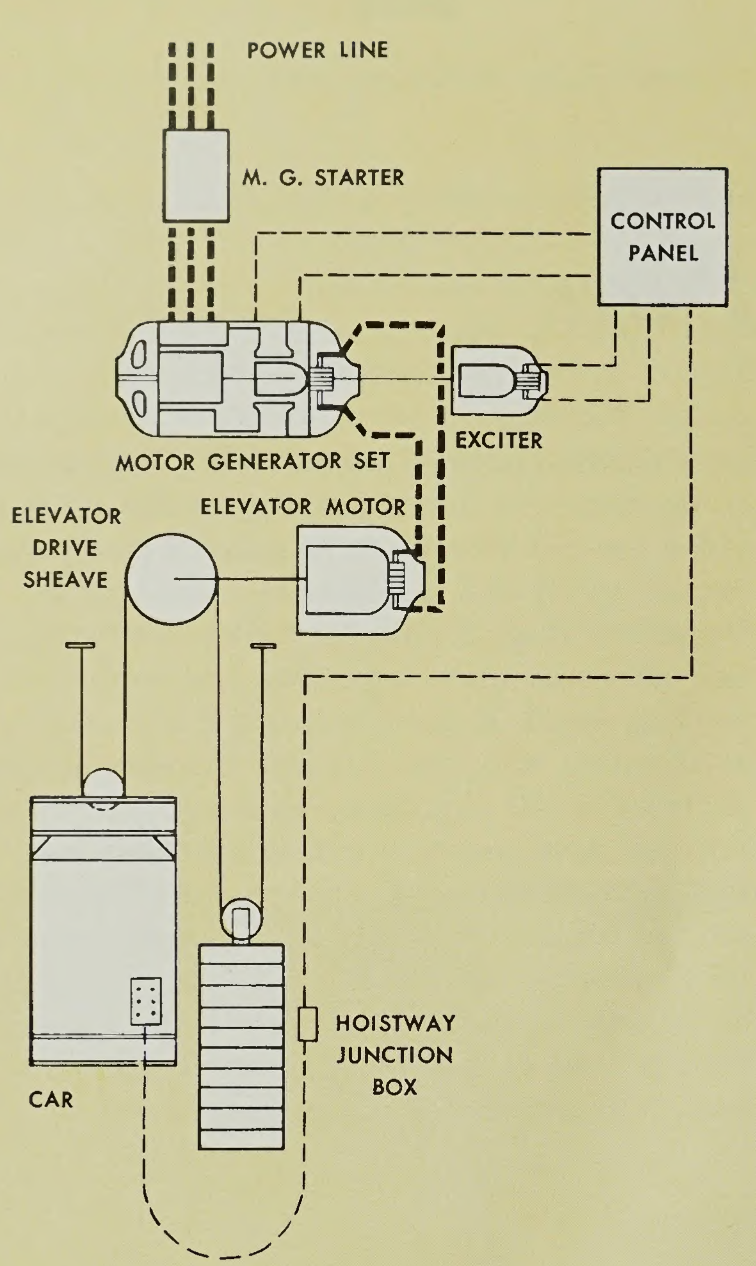


Figure 5. Schematic of Variable Voltage Equipment

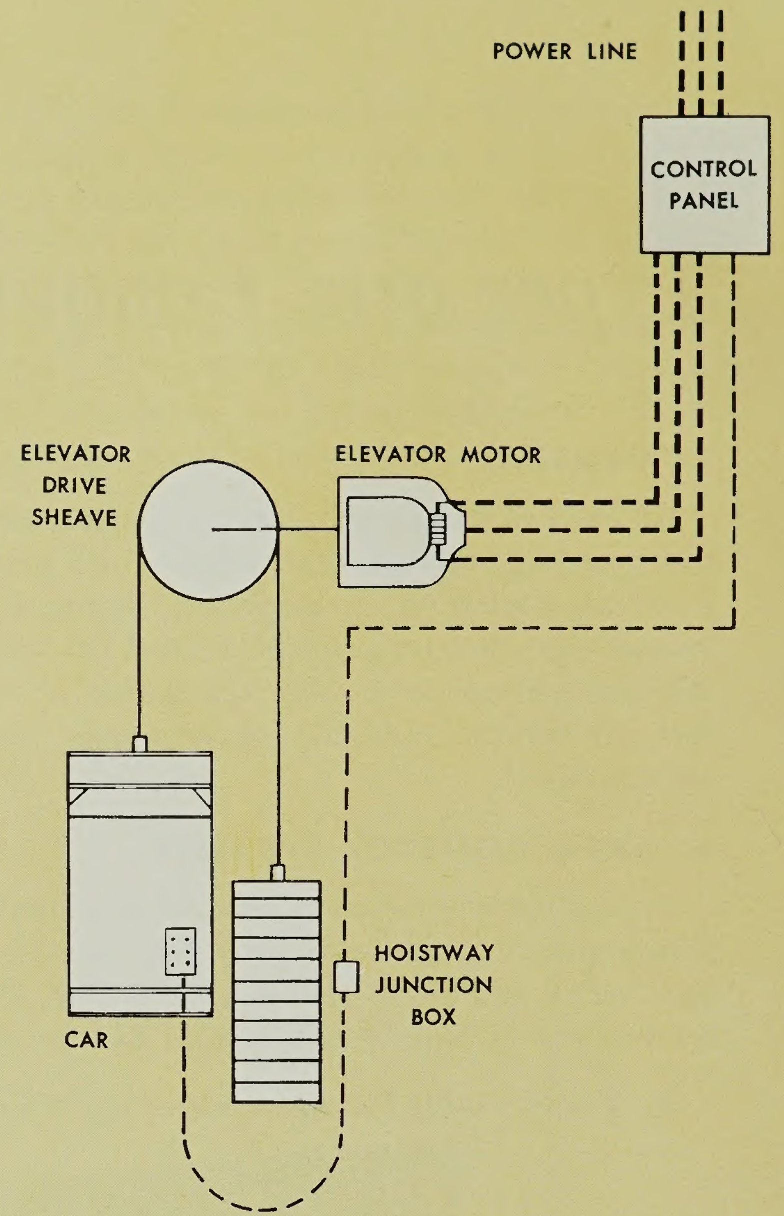


Figure 6. Schematic of Rheostatic Equipment

heavy pallet or skid loads are placed in the elevator with small wheeled trucks.

2. ***The A-C Rheostatic system** (figure 6)* is often suitable where the elevator is used infrequently and when it is desirable to limit the investment in the equipment.

> **NOTE:** Infrequent use implies an average of less than five trips per hour on a normal business day.

Whenever the normal landing accuracy of the A-C Rheostatic system is not adequate for the loading methods anticipated, one of two special features may be used to increase landing accuracy.

a. *Inching.* This feature of "inching" may be added to the controller for a single speed A-C motor at nominal cost. It permits moving the car to floor level within a limited zone of approximately nine inches, either side of the floor, with the doors open.

b. *Automatic Leveling.* This feature requires a two-speed elevator motor and control apparatus. It is available only with Selective Collective or Single Automatic control operation at speeds up to 100 feet per minute with capacities up to 8000 pounds, and at 75 feet per minute with 10,000 pounds capacity. (See Section 5, Page 22, paragraph B.)

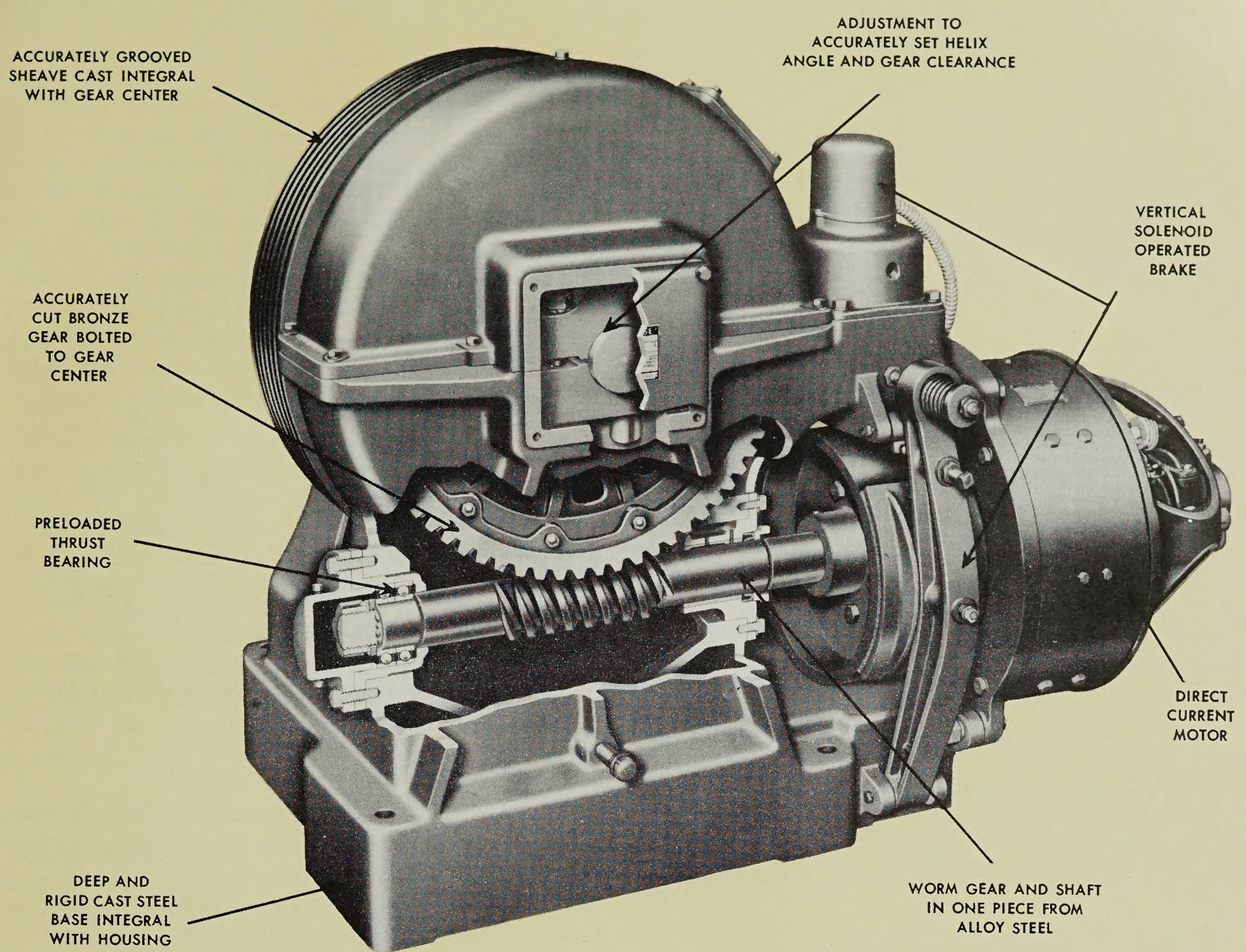


Figure 7. Cutaway View of Geared Machine with D-C Motor, Showing Worm Shaft Assembly

C. COMPONENT PARTS

1. *Machine and Motor* (*figure 7*).

a. GEARED MACHINE. The Westinghouse geared machine consists of a worm, a gear and sheave mounted on Timken bearings, a brake, and a flange-mounted motor—all accurately and rigidly assembled into a single unit.

The unit-frame design allows correct alignment, and minimizes the chances of deflection during shipment and installation. The flange-mounted motor provides a particularly rigid connection between the motor and the machine resulting in minimum noise and wear and increased efficiency.

b. BRAKE ASSEMBLY. The brake is mounted as an integral part of the gear housing. Braking action supplied by springs assures definite stopping when power is shut off. Two pivoted brake shoes, self-aligning in both directions, are lined with special asbestos material. The brake is released by a specially designed direct current magnet. Operation is extremely quiet. A large braking area is used resulting in low unit pressure, long life and smooth, constant deceleration when the brake is applied. The large area also enables one brake shoe to hold the load while the other is removed for service.

c. WORM GEAR. The worm and its shaft is made in one piece from alloy steel, ground finished and is supported by two bearings. The thrust bearing, which takes both radial and thrust loads, is an oversize duplex ball bearing mounted on the end of the worm shaft. It is specially made to eliminate end play. Bearings are preloaded, thus assuring long life. A bronze sleeve guide bearing equipped with a specially designed oil seal is located in the gear housing. The main gear is machined from a heavy ring casting of bronze. Teeth are cut accurately by a gear hobbing machine. The gear ring is mounted on the machine periphery of the gear center which is cast integrally with the sheave and is held in place against the machined face of the flange by bolts and nuts which are fitted accurately in reamed holes.

d. SHEAVE. The sheave is a cast spider of special alloy, semi-steel with heavy arms and rim. Rope

grooves are of preform "V" contour, machined accurately in the rim and are so designed as to assure uniform traction throughout the life of the machine. The design permits re-grooving, thus assuring long life.

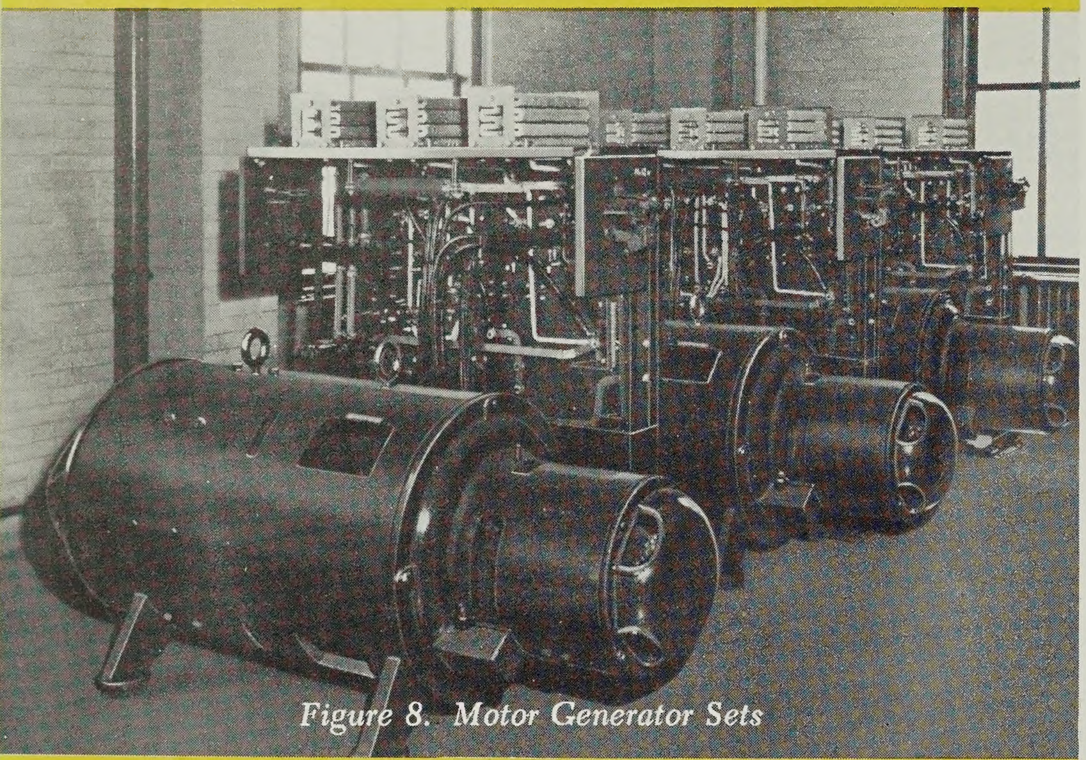


Figure 8. Motor Generator Sets

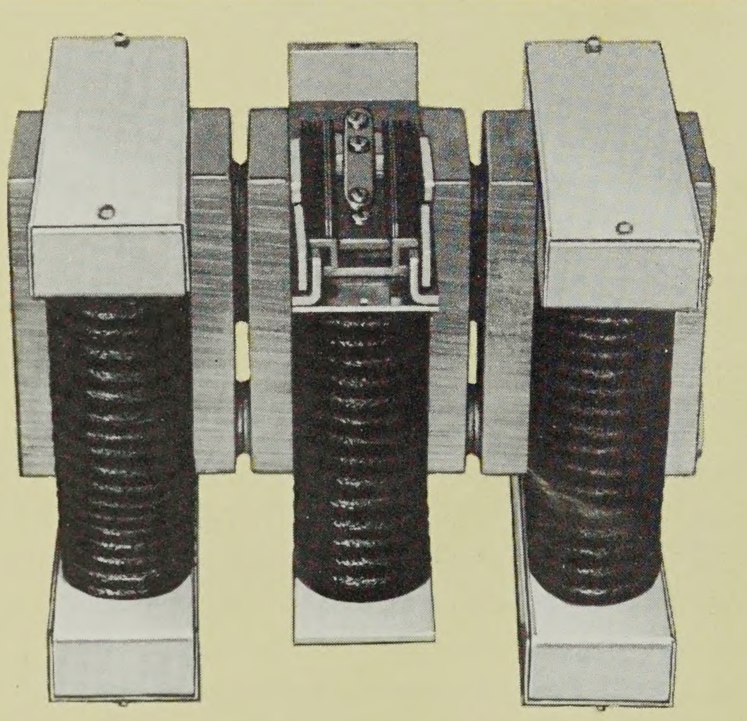


Figure 9. Car Inductors

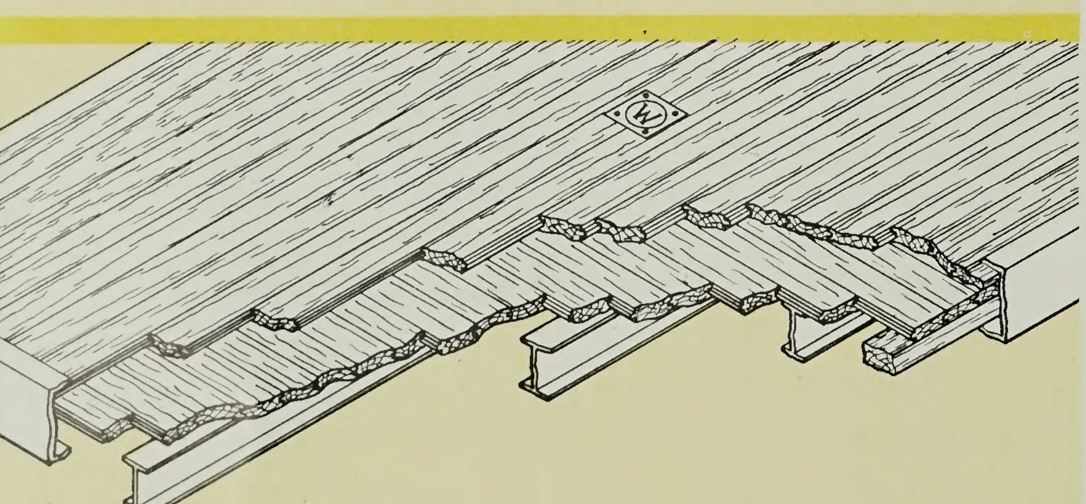


Figure 10. Platform

e. The sheave and gear center unit rotates on two precision type tapered roller bearings. These bearings support all the suspended loads, and are chosen for their inherent characteristics to remove all play or lost motion and thereby maintaining permanent alignment between the worm and gear and, like the other bearings, are designed to last for the life of the elevator. They are lubricated by the oil used to lubricate the worm and gear. The inner race is mounted on a stationary forged steel shaft so that minimum misalignment will occur due to flexure.

f. Provision is made on all machines for adjusting the alignment supports for the main shaft to permit adjustment in any direction. Adjustable helix angle bearing design or a simple eccentric in larger machines permits lowering of gear to eliminate back lash that may develop after long service.

g. For Alternating Current Rheostatic Control, a Westinghouse polyphase squirrel-cage motor is used. For Variable Voltage Control, a direct current motor is used.

2. *Motor Generator Set (figure 8).*

If variable voltage equipment is specified, a motor generator set is supplied to furnish direct current to the elevator motor.

The motor generator set is of unit frame construction and is accurately balanced. It is supported by four legs welded to the frame and is isolated from the building with neoprene blocks. A direct-connected exciter on the larger sizes and a dry type rectifier for the smaller sizes supply power for the control circuits, fields, and brake coils.

3. *Control Accessories.*

All Westinghouse elevator hoistways are provided with limit and overtravel switches at the top and bottom landings. Automatic elevators are provided with inductor stopping devices. Self-leveling elevators are equipped with releveling inductors.

The inductor system levels the car automatically to floor level regardless of variation in rope stretch during loading and unloading. The inductor switch mounted on the car consists of normally closed contacts, a coil and magnet. By means of stationary plates mounted in the hoistway and passing through the magnetic paths of the switch, the contacts are caused to operate and thereby, through relays, control the leveling of the car. *(Figure 9.)*

4. *Platform (figure 10).*

Westinghouse freight elevator platforms are designed for normal industrial truck and pallet loading and are built for rigidity and severe use. The

platform consists of a heavy steel channel frame with closely-spaced stringers of steel channels or I-beams. The frame and stringers are welded together into an integral unit to withstand heavy concentrated loads. A heavy pine sub-floor is fastened to planks bolted to the stringers, and a hard maple top floor is laid over the sub-floor. If desired, end grain Worthwood, leather or steel checkered plate flooring may be supplied at extra cost.

5. *Sling (figure 11).*

The Westinghouse freight sling is a rigid steel support for the platform and cab. It also carries the safety, guide shoes, and other accessories as the type of installation may require. The sling is bolted together into one complete unit and consists of double steel channel top and bottom beams, heavy steel channel or wide flange beam side uprights, steel gusset plates, and diagonal bracing to support the platform.

6. *Cab (figure 12).*

Westinghouse freight cabs are built of heavy gauge steel panels with turned edges, suitably reinforced and finished in durable gray lacquer. The solid metal top has a hinged panel at one end for exit purposes. The panel extends the full width of the cab. A light fixture, recessed in the top and protected by a wire guard, is provided. The car control station is located in a recessed panel to prevent damage from trucks and material. When the elevator is loaded by power trucks heavy maple rubbing strips, bolted to the side walls approximately 15 inches from the floor, are recommended.

7. *Gate Equipment and Operation.*

The standard car entrance supplied for all freight elevators is a counterbalanced vertical-rise gate extending the full width of the car. The gate is constructed of expanded metal Saf-T-Mesh with a reinforced steel frame. The frame is equipped with suitable guide shoes which run on tracks fastened securely to the car enclosure. Guided counterbalanced weights, which cannot become displaced or fall below their normal limit of travel, are connected to the gate by cable.

a. *Gate Contact.* The freight car gate is equipped with an electric contact which prevents operation of the car unless the car gate is closed. The contact is of approved type and tested as required by code.

Figure 11. Sling and Platform

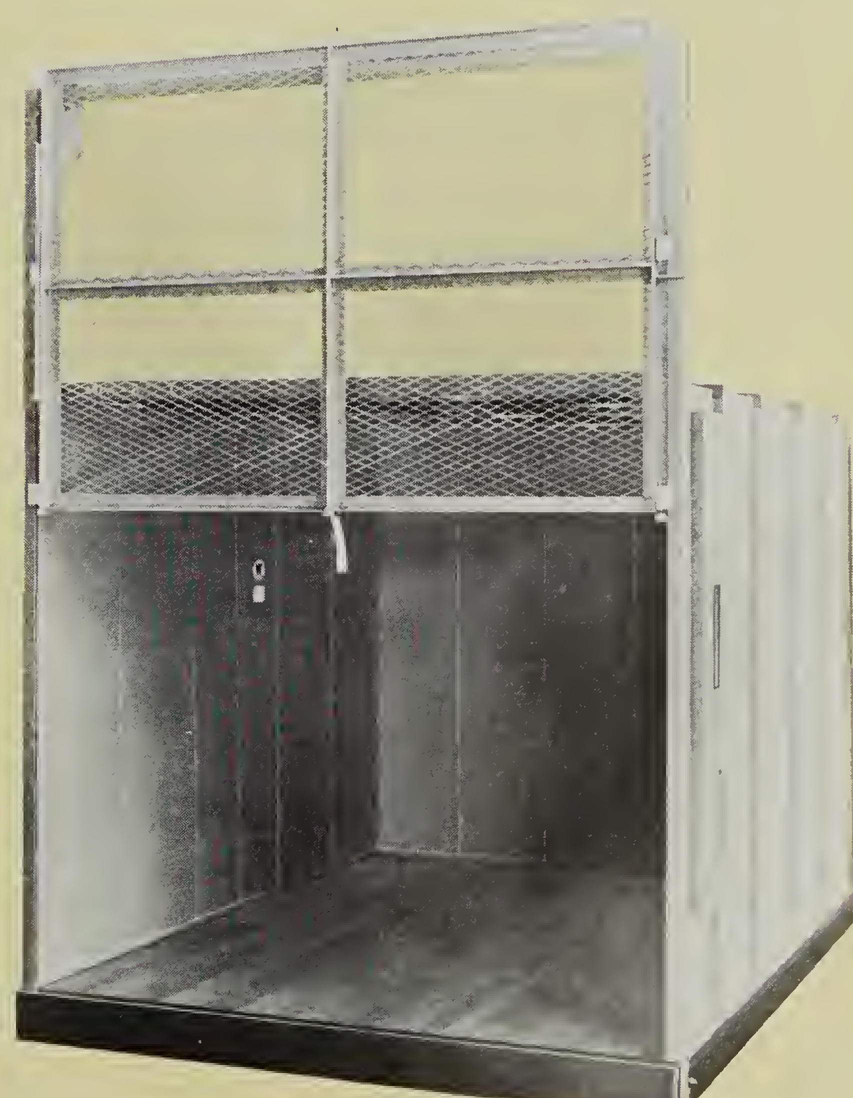


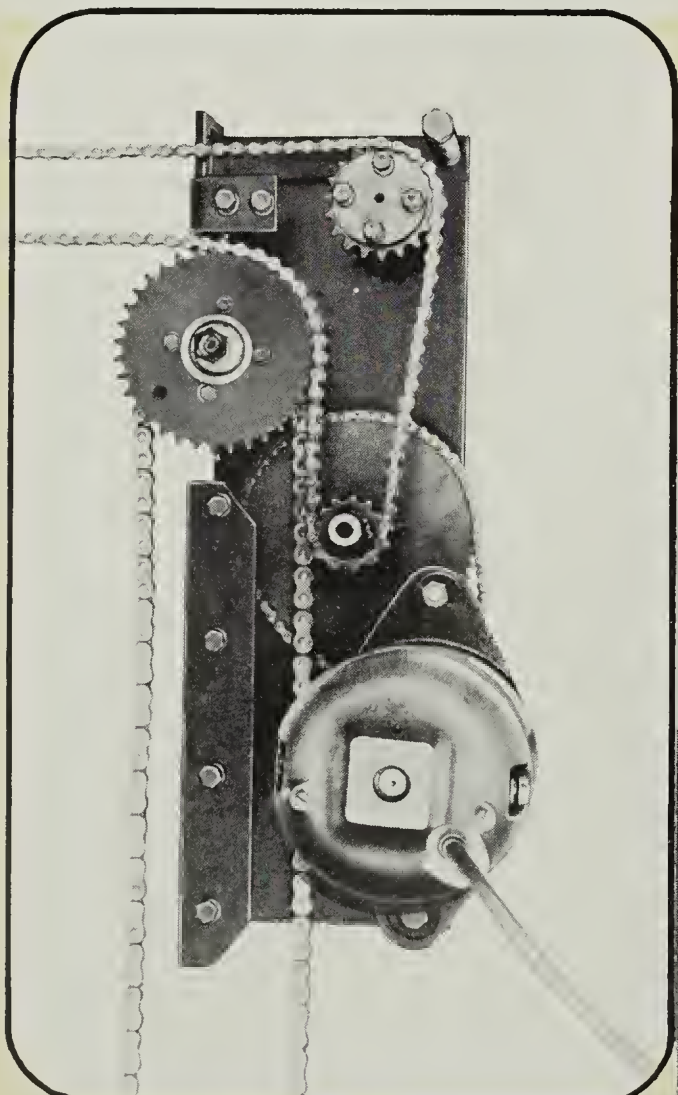
Figure 12. Cab

8. Hoistway Doors (figure 13).

Westinghouse standard equipment for the freight hoistway entrance is a counterbalanced vertical-sliding, center-parting door, complete with guides and hardware. The door is composed of a solidly constructed wood core covered with sheet steel having vertical lock seams, or it is of steel plate or hollow-metal construction. The upper door section is provided with a glass vision panel. The upper edge of the lower door section is provided with a heavy steel truckable sill for smooth access to the platform. The door sections are connected to each other by a steel chain passing over roller bearing sheaves. Proper electrical interlocks are provided to prevent the elevator from being operated while the doors are open. Hoistway doors may be either power operated or manually operated depending upon the type of elevator control and use. Proper consideration must be given to structural supports for the hoistway doors.

a. *Power Door Operator.* An individual motor door operator, mounted on suitable supports, is used for each hoistway door. The drive mechanism consists of a chain and sprocket reduction and a driving motor. The door panels operate at one foot per second.

b. *Gate Operator.* This consists of a motor drive incorporating a V-belt reduction and a chain and sprocket reduction. Two sprocket chains are attached to opposite sides of the gate and, after passing over the driving sprockets, are secured to the gate counterweight. The gates operate at two feet per second.



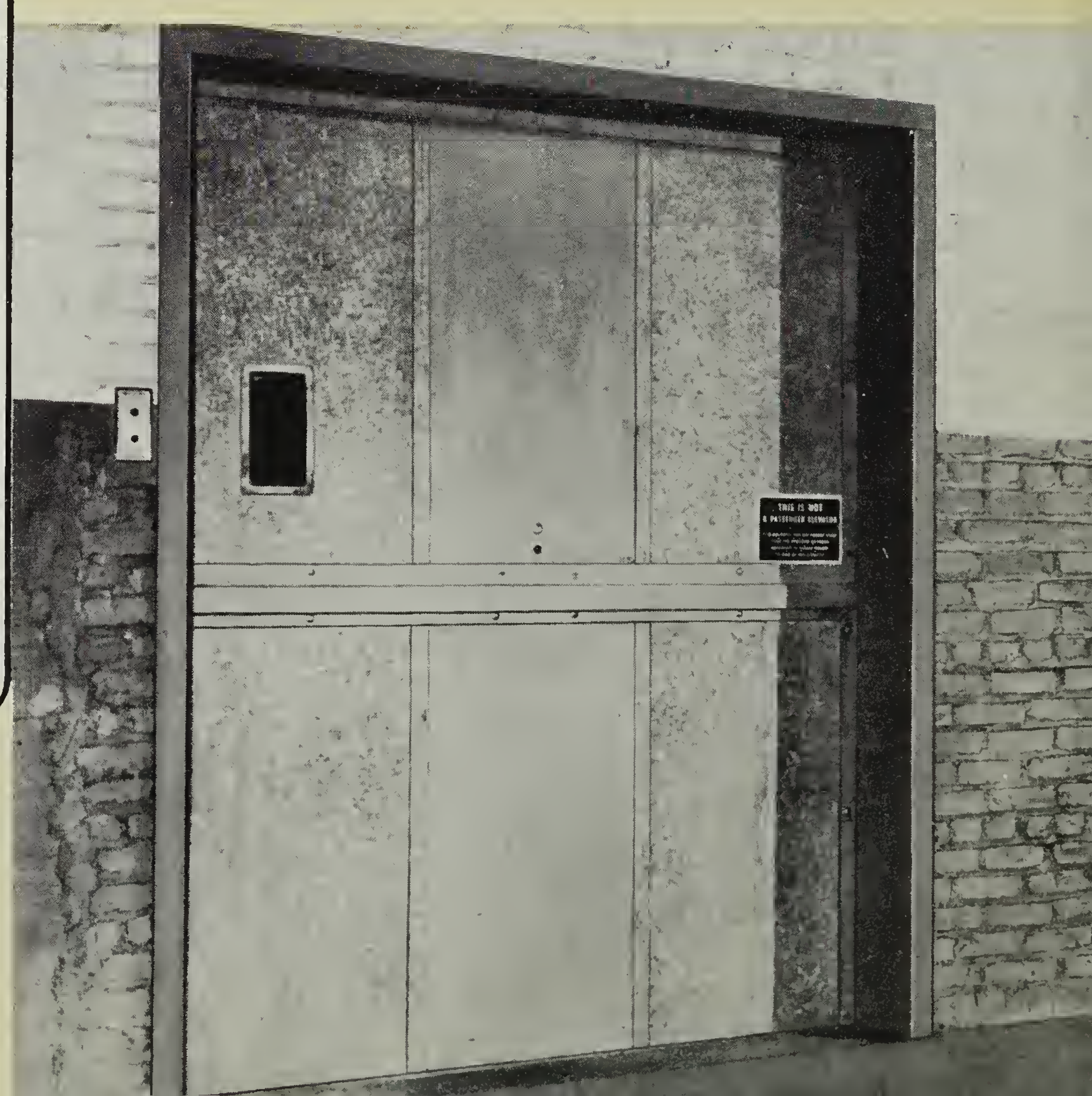


Figure 13. Hoistway Door and Electric Power Door Operator

9. Governors (figure 14).

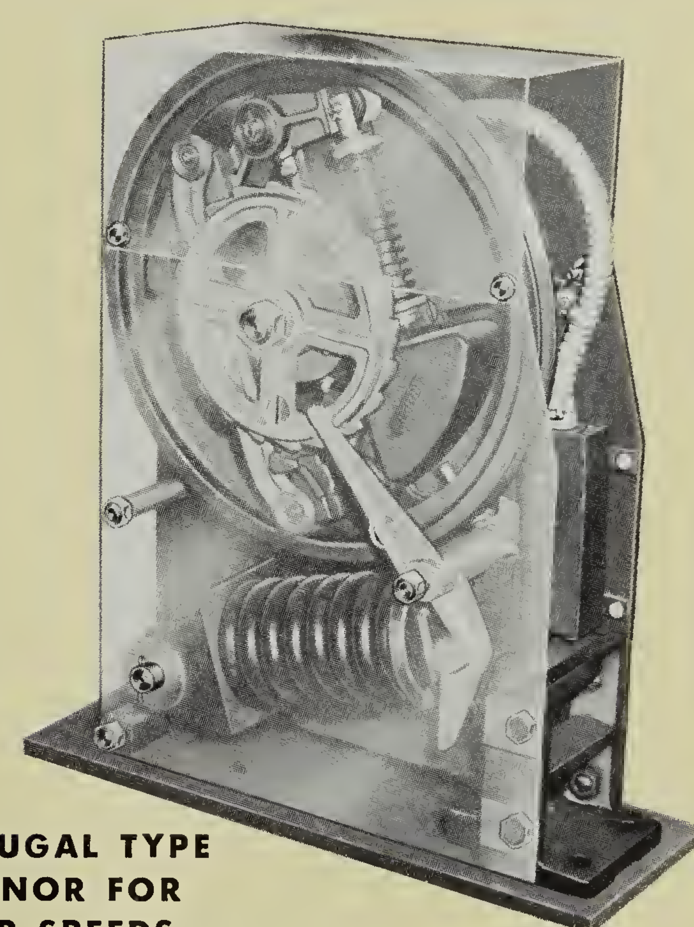
Westinghouse governors are of the centrifugal principle. The application is determined by the speed of travel and related apparatus. The low-speed governor is used in conjunction with the Instantaneous type safety. The higher speed governors are used in conjunction with the Gradual Wedge type safety.

The function of the governor is to safeguard against overspeeding of the car. This is accomplished in the following manner: If a car begins to speed beyond its limits, the governor contact is opened thereby cutting off the power and applying the machine brake. Should the car continue to overspeed, the spring-backed parallel jaws are released. These jaws grip the governor rope with a predetermined pressure sufficient to actuate the safety mechanism without abrading or abnormally stressing the governor rope.

10. Safeties.

a. FLEXIBLE GUIDE—CLAMP SAFETY *(figure 15).* This safety is used on all freight elevators for speeds exceeding 100 feet per minute. The safety mechanism is incorporated in the bottom beam of the sling under the platform. It exerts retarding force in not more than 30 inches of car travel after the operation of the governor in case of overspeed. A constant retarding force is applied to the rails by two pairs of steel jaws with equalized pressures. This retarding force is sufficient to bring the car and load to a smooth and gradual stop. Normal running clearance is one-fourth inch between each safety jaw and the rail.

CENTRIFUGAL TYPE GOVERNOR FOR LOW SPEEDS



CENTRIFUGAL TYPE GOVERNOR FOR HIGHER SPEEDS

Figure 14. Governors

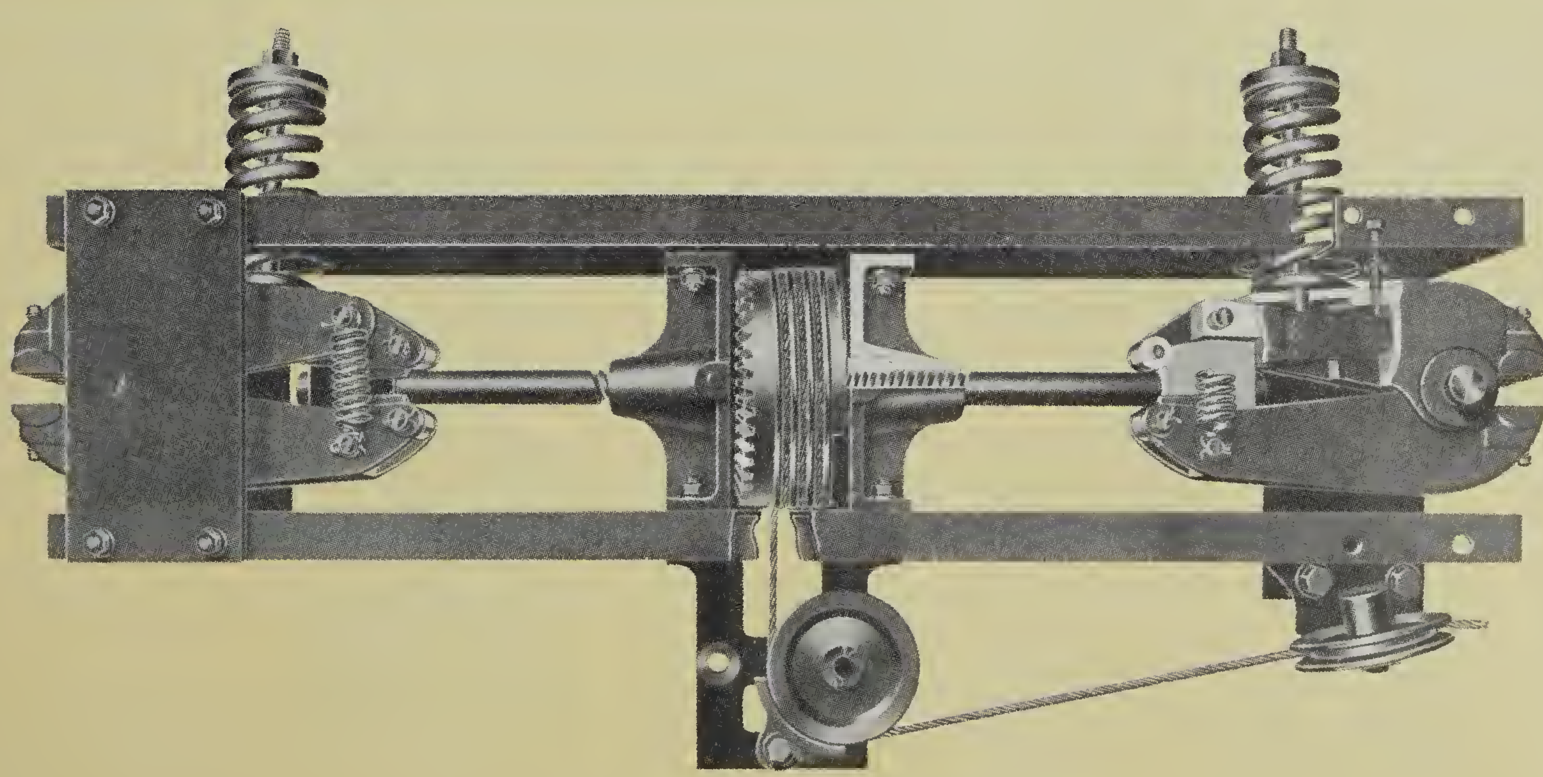


Figure 15. Flexible Guide-Clamp Safety

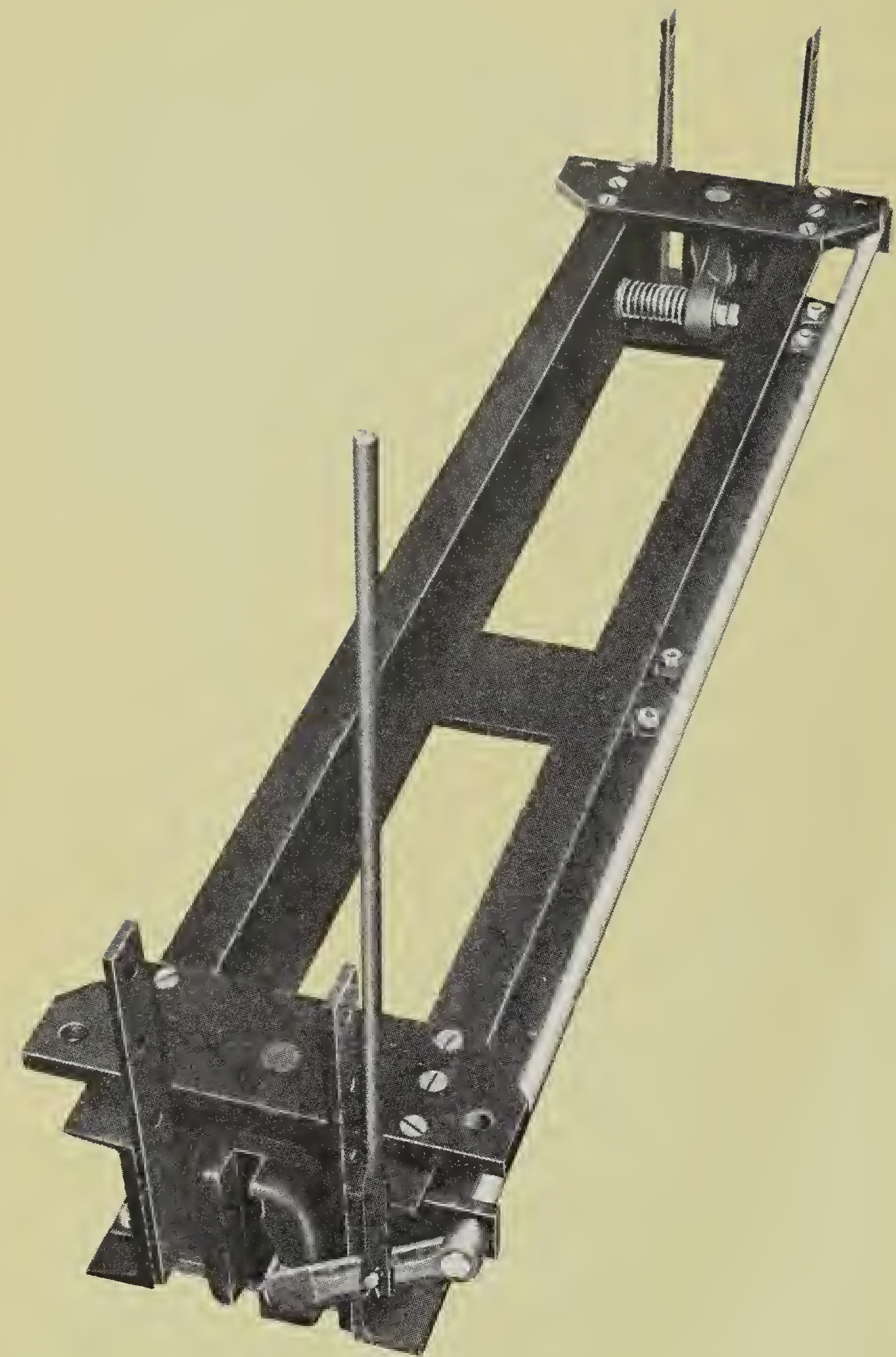


Figure 16. Instantaneous Safety

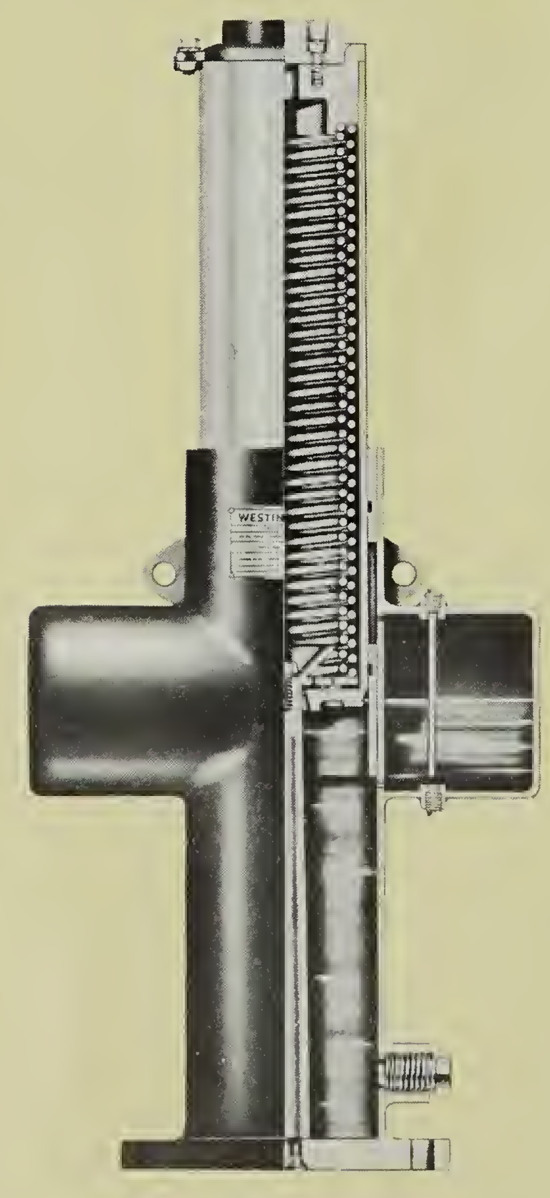
b. INSTANTANEOUS SAFETY *(figure 16).* This safety is used on all freight elevators with speeds up to and including 100 feet per minute. Like the Flexible Guide-Clamp Safety, it is incorporated in the bottom beam of the sling. When the safety mechanism is tripped, a knurled steel roller at each end of the bottom beam is forced between the safety casting and the rail, clamping the guide rail between the face of the safety casting on one side and the roller on the other. The heavy safety casting is pivoted and spring biased to avoid any sling or guide shoe distortion. Normal running clearance between each safety jaw and rail is approximately one-fourth inch.

***11. Buffers** (figure 17).*

Spring type buffers for the car and counterweight are used when the rated speed is less than 200 feet per minute. If the rated speed is 200 feet per minute or greater, oil buffers are supplied.

a. *Spring buffers* are designed of heavy spring steel, helical shaped and of sufficient strength to retard and stop the car.

b. *Oil buffers* are of the spring return type and are designed to bring the car and counterweight to rest from governor tripping speed at an average rate of retardation not exceeding gravity without a noticeable peak retardation. Constructed like a modern gun recoil mechanism, the oil buffer provides a gradually increasing cushion effect. Oil, contained in a large reservoir, is the hydraulic element employed. A strong steel helical spring is also compressed and returns the plunger to its original position after the load is removed.



OIL BUFFER

SPRING BUFFER

Figure 17. Buffers

12. *Counterweight.*

The Westinghouse standard counterweight consists of a welded frame in which cast iron sub-weights are mounted. The weight of the counter-weight is normally equal to the weight of the car plus 40% of the capacity. This amount of balance usually results in the lowest power consumption and, under normal conditions, will provide adequate traction with both loaded and empty car.

13. *Guide Rails and Shoes (figures 18 and 19).*

a. GUIDE RAILS. Westinghouse steel guide rails are of standard section and weight. They are machined accurately on the face and two sides, and the ends are tongued and grooved to insure proper alignment and smooth even-running surfaces. Heavy steel brackets fasten the rail to the building structure at closely spaced intervals to minimize rail deflection. Where the normal spacing of structural beams is not sufficiently close, additional vertical structural members to which the guide rails may be fastened should be incorporated in the steel structure. *(Figure 18.)*

b. GUIDE SHOES *(figure 19).* Solid guide shoes with renewable gibs are furnished when the rated speed does not exceed 200 feet per minute. The shoes are fabricated of solid cast iron accurately machined and fastened to the car sling and safety and to the counterweight frame by means of mounting plates. The mounting is adjustable to obtain proper running clearance. Automatic feed guide lubricators are mounted to the top shoes of the sling and counterweight to evenly lubricate the two sides and face of the rail.

14. *Ropes.*

Westinghouse hoist ropes are of high grade traction steel especially designed for elevator service. The ropes are babbitted securely at both ends into steel shackles.

15. *Chain Compensation.*

In general, compensation for the weight of the hoist ropes is not necessary when the elevator travel does not exceed 100 feet. Westinghouse compensation is standard equipment, however, for all freight elevators where it is needed. Compensation consists of two steel chains interwoven with sash cord and fastened securely to the underside of the car and counterweight.

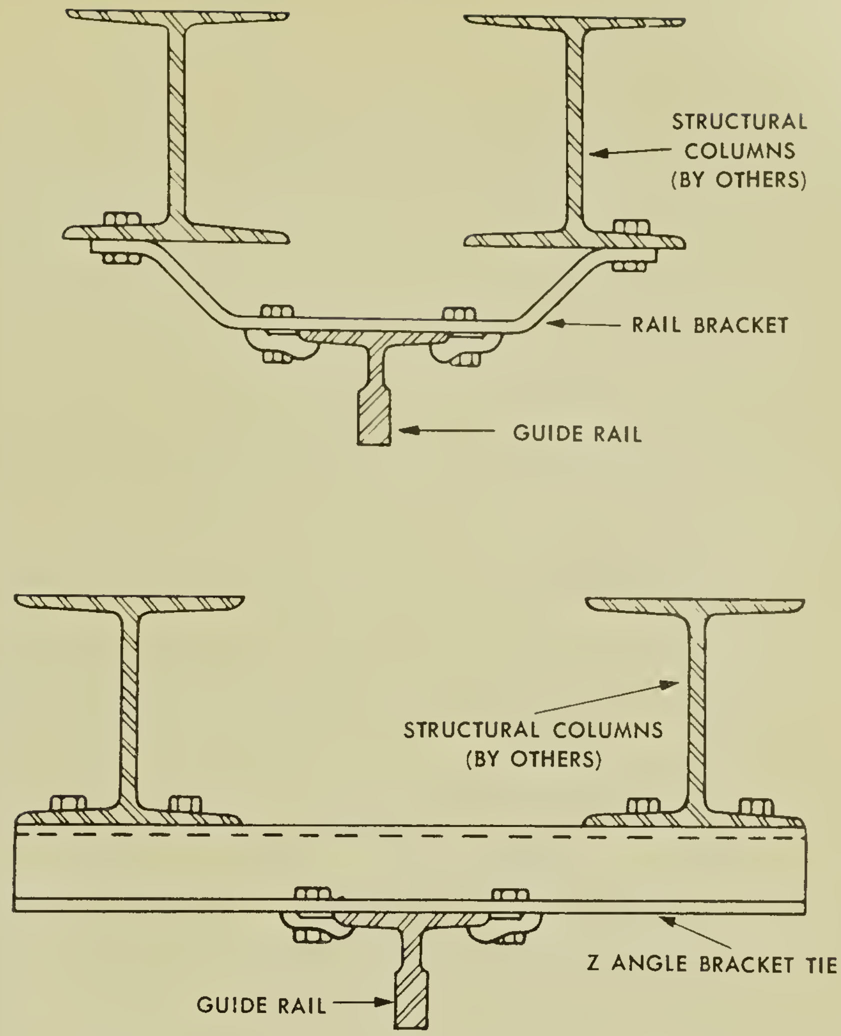


Figure 18. Guide Rails and Additional Vertical Structural Members

Figure 19. Guide Shoes

Elevator Lifting Capacity and Size

A. GENERAL.

The selection of the proper capacity and size of freight elevators follows no well-defined pattern. Each installation is an individual study of many factors.

Basically, the following information must be known:

1. Building Characteristics. The building characteristics which determine the freight elevator operation are:

a. *Floors.*
   Number of floors.
   Floor heights.
   Number of floors requiring front and rear elevator entrances.

b. *Travel.*
   Distance from first floor to top floor.

c. *Structural Conditions.*
   For supporting the elevator.
   For elevator space requirements.

2. Elevator Loads. The actual loads to be carried on the freight elevator and the method of loading should be determined.

a. *Actual Loads.*
   The maximum weight and size of the loads.
   Packaged or boxed units.
   Heavy machinery.
   Bulk loads.

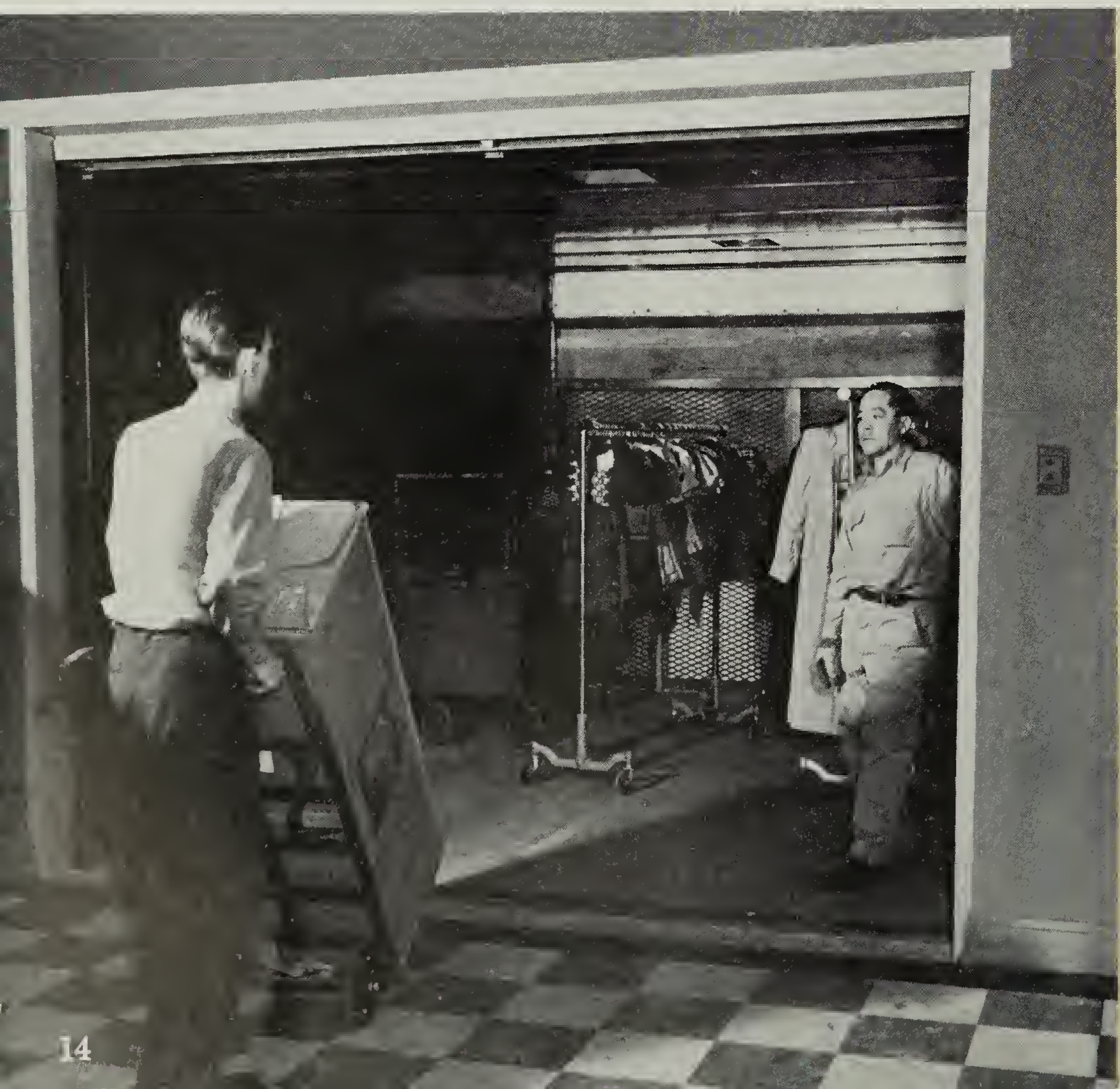


Figure 20.
Hand Truck Loading

b. METHOD OF LOADING. *(Figures 20 and 21.)* It should be known whether hand trucks or power trucks will be used, whether the trucks will ride with the loads, and what the weight of the trucks is. Particular attention should be given to frequent unusual loading requirements peculiar to the individual plant or industry, since uniformity of unit loads in weight or dimensions is not always practicable each time the elevator is loaded. These and other loading factors, particularly capacity and car size, bearing on elevator practices should be analyzed carefully so that no needless limitation is imposed on the overall availability and efficiency of the freight elevator installation.

3. Specific Requirements. The following factors must also be taken into account since each elevator installation must be based upon the specific requirements of a particular building.

a. The number of units to be handled per hour in each direction. The load per hour in pounds. The tonnage per day.

b. The probable cycle of operation and the principal floors served during the peak of the cycle.

c. The number of passengers, if any, the elevator will handle during periods of peak passenger traffic.

Figure 21. Power Truck

Palletized Material Handling

The above considerations suggest that the selection of the proper capacity and size for a particular freight elevator installation involves a detailed study of the entire material-handling equipment of which the elevator is a part. The following provides some general data and conditions which effect the choice of an elevator.

B. CAPACITY AND LOADING

The following table lists sizes for platforms and openings as standardized by the industry to provide economical freight elevators.

TABLE 1

INSIDE CAR SIZE		STANDARD PLATFORM SIZE		STANDARD CAR OPENING SIZE	STANDARD CAPACITY RATING IN POUNDS
WIDTH	DEPTH	WIDTH	DEPTH		
5′0″	6′6″	5′4″	7′0″	5′0″ x 8′0″	2500, 3000
6′0″	7′6″	6′4″	8′0″	6′0″ x 8′0″	2500, 3000, 4000
8′0″	9′6″	8′4″	10′0″	8′0″ x 8′0″	4000, 5000, 6000, 8000
8′0″	11′6″	8′4″	12′0″	8′0″ x 8′0″	5000, 6000, 8000, 10,000
10′0″	13′6″	10′4″	14′0″	10′0″ x 8′0″	10,000
10′0″	15′6″	10′4″	16′0″	Usually determined by load characteristics	12,000
10′0″	19′6″	10′4″	20′0″		14,000
12′0″	15′6″	12′4″	16′0″		16,000, 18,000, 20,000
Special		Usually determined by load characteristics			24,000, 30,000

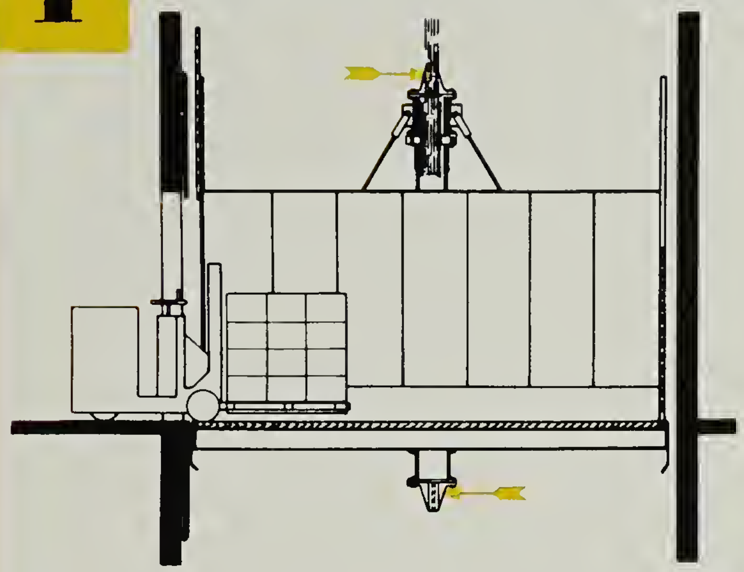
Several capacities are listed in the above table for certain platform sizes. These are necessary to meet industrial requirements for handling both heavy and light products. The probability of platform overloading is reduced to a minimum by installing the smallest platform that is adequate to carry the load.

The dimensions of the units handled and the size of the pallets, skids or hand trucks used determine the dimensions of the car for a given capacity. Unless the hoistway size is fixed, the platform should be a standard size to avoid the higher cost of a nonstandard platform. Standard eight foot high cars are generally used up to 10,000 pounds capacity unless the power truck or load exceeds this height. Above 10,000 pound capacity a 10′ 2″ height is usually considered standard.

Determination of the capacity rating must include consideration of the intended initial or probable future use of power trucks for placing skidded or palletized material on the car. The employment of power trucks for moving material in industrial plants is increasing and because of their concentrated heavy loads they cause greater stresses on the car structure and guide rails than the older practice of loading by hand trucks. Rating of the elevator must equal the actual load to be transported with due consideration given to the weight of power trucks used in loading, even though they are not transported on the elevator. The elevator equipment must be capable of transporting not only the load but also must be able to support and, where necessary, to level the sum of the load to be transported plus the weight of the truck. Obviously, the relative weights of truck and load will influence the application. Where the weight of the truck is a fair percentage of the load, it may be necessary to choose the next larger elevator.

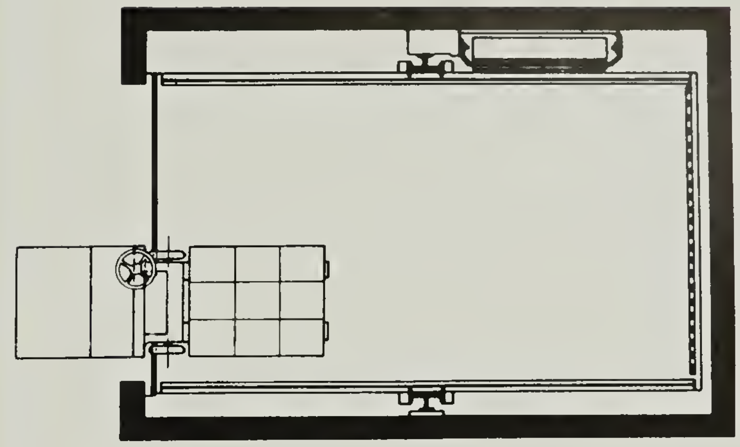
The truck with its entire load entering the elevator causes severe eccentric loading by concentrating the weight of the truck and load at the edge of the platform; (*figure 22*) illustrates this condition.

1

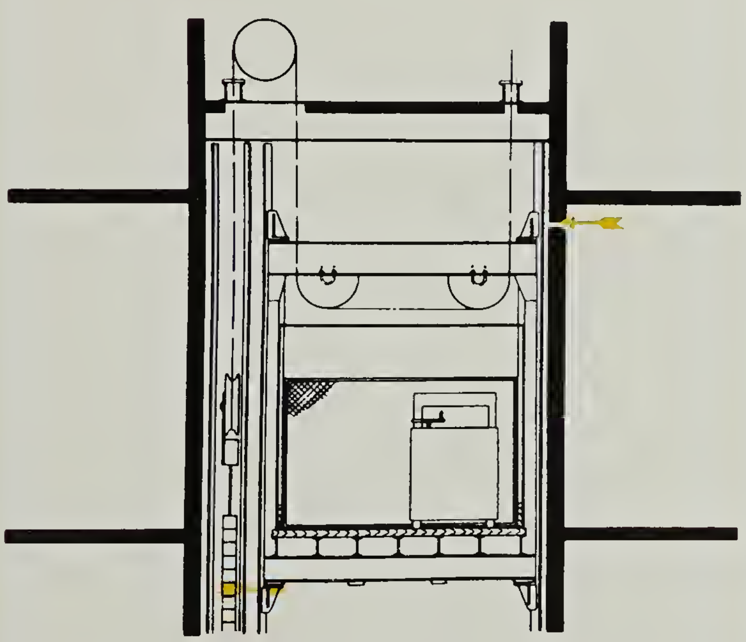


This shows the power truck with its palletized load just as it enters the elevator. Most of the weight of the truck and the load is concentrated at the edge of the platform. The arrows indicate the reactions at the guides.

2

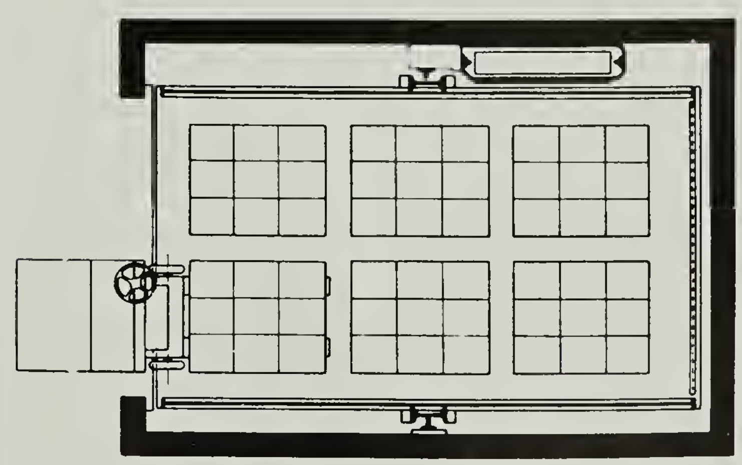


This is a plan view of the condition illustrated in 1. The load is not only concentrated on the edge of the platform but it is displaced sidewise.



This is an elevation of the condition shown in 1 and 2. The arrows indicate additional reactions at the guides.

3



This is a plan view of a loaded elevator as the last truck load is being deposited. While the truck forks are still supporting the load, the total load on the elevator is its full load plus most of the weight of the truck.

4

Figure 22. Power Truck Loading Diagrams

C. PASSENGER TRAFFIC *(figure 23).*

Freight elevators may be used for passenger transportation if they meet local code requirements for such use. The following are the most important safeguards that should be incorporated:

Capacity rating equal to that for a passenger elevator of the same net area.

> **NOTE:** Some jurisdictions permit a limited use of standard freight elevators for handling passengers.

Interlocks on hoistway doors instead of contacts and locks.

Synchronizing of the car gate and the vertical counter-balanced hoistway door so that the hoistway door opens first and the car gate closes first to eliminate the tripping hazard. This can be best accomplished with power operated doors.

Table 2 lists the minimum capacities recommended for various sizes of freight elevators if used to carry passengers.

TABLE 2

PLATFORM SIZE	NET AREA SQ. FT.	PASSENGER RATING	RECOMMENDED RATING
5'4" x 7'0"	32.5	2900	3000
6'4" x 8'0"	45.0	4350	5000
8'4" x 10'0"	76.0	8400	8000
8'4" x 12'0"	92.0	10,500	10,000
10'4" x 14'0"	135.0	16,600	16,000

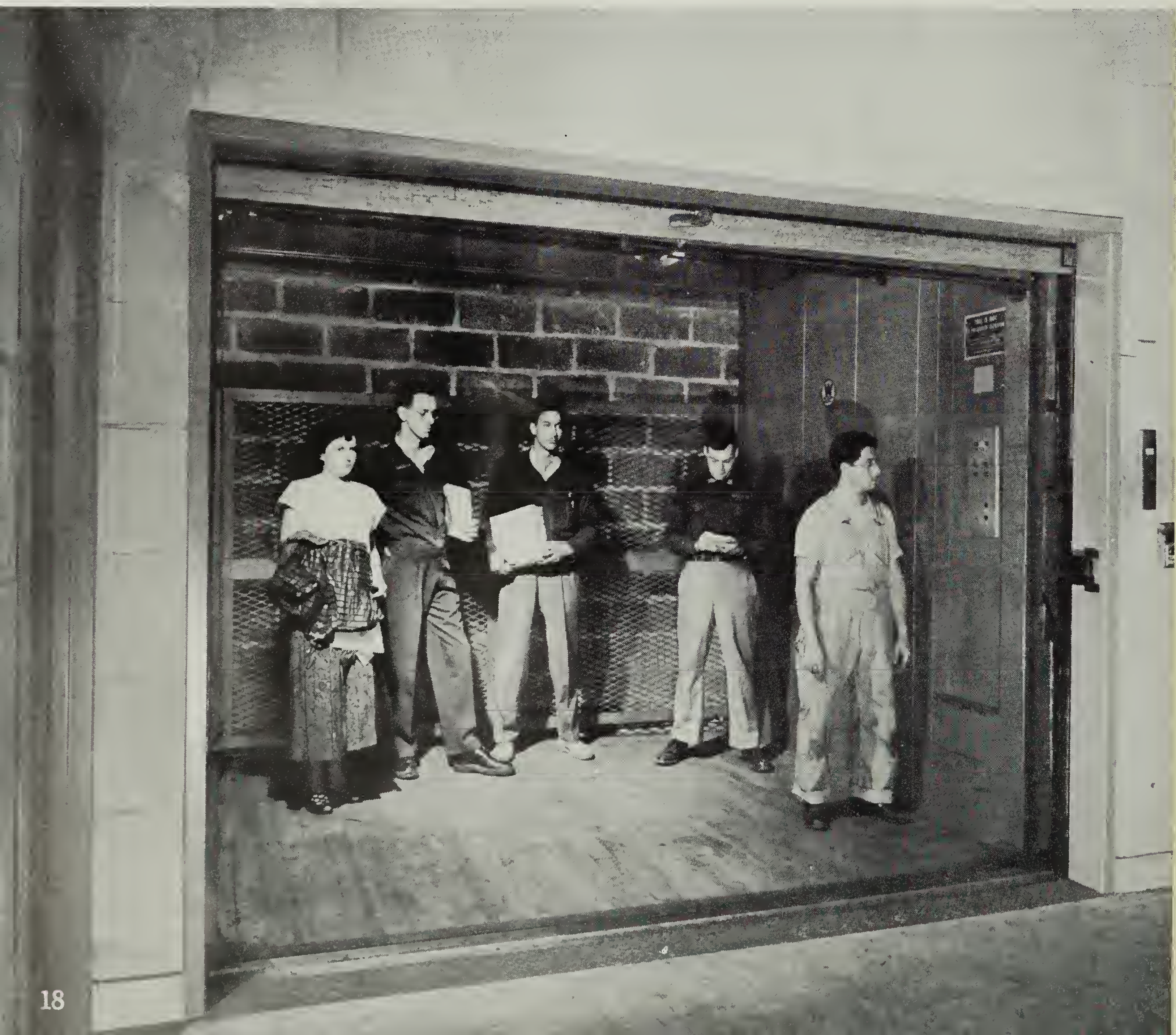


Figure 23. Passenger Traffic on Freight Elevator

The recommended rating is either the next larger even rating or the next smaller even rating (expressed in thousands of pounds) where the passenger rating does not exceed the even rating by more than 5 per cent.

> **NOTE:** Since passenger crowding cannot easily be avoided, the recommended rating should be taken as the minimum rating.

Freight elevators suitable for passenger service are recommended in buildings of three or more floors in order to transport employees during rush hours. If passenger traffic interferes with freight handling during working hours, consideration should be given to the installation of additional elevators for passenger service only. (Figure 24.)

D. FUTURE USE

The elevator size and capacity should provide for probable future uses and loads, so that it can be designed to give adequate service for many years.

The following questions should be considered:

a. Will the manufacturing facilities expand?

b. Will the products now manufactured increase in size or weight?

c. Will the load per hour increase?

E. BUILDING CONDITIONS

The structural conditions of the building which may influence the platform size, shape and/or capacity must be taken into account in planning for a freight elevator.

Figure 24. Additional Passenger Elevator

Elevator Speed Requirements

A. GENERAL

As in the case of capacity and size, the determination of the proper speed for a particular freight elevator involves a detailed study of the entire material-handling equipment of which the elevator is a part. (See Section 3, Page 14, paragraph A.)

Inadequate freight elevator service results in lowered efficiency because of failure to maintain production schedules, employee lost time, crowded aisles, and elevator overload hazards. All these elements are costly. They are, however, avoidable if the correct elevator and elevator speed are chosen to meet present and possible future demands.

The following discussion will be useful for a preliminary choice of the required speed.

B. STANDARD SPEEDS

Experience shows that the most suitable elevator speed is determined by the type of elevator control used, by the number of floors served, and by the elevator capacity.

1. Variable Voltage Geared Equipment *(see section 2, page 5, paragraph B., 1).* The recommended application of the speeds is as follows: 100 feet per minute for two or three floors; 150 feet per minute for four or five floors; and 200 feet per minute for six to ten floors.

> **NOTE:** If one of the floors exceeds 20 feet in height, the next higher speed is desirable. Higher speeds are available when needed.

2. A-C Rheostatic Geared Equipment *(see section 2, page 6, paragraph B, 2).* Selection of speeds is recommended as follows: 50 feet per minute for two floors; 75 feet per minute for three or four floors; and 100 feet per minute for five to eight floors.

> **NOTE:** If one of the floors exceeds 20 feet in height, the next higher speed is desirable.

3. Speed Application Table. The data in the paragraphs 1 and 2 above are summarized below in table 3 for convenience. This table provides a close method of determining the speed based on the number of floors.

TABLE 3

CONTROL SYSTEM		ELEVATOR SPEED†
FLOORS* VARIABLE VOLTAGE	FLOORS* AC RHEOSTATIC	(feet per minute)
	2	50
2 or 3 (10,000 pound capacity)	3 or 4	75
2 or 3	5 to 8	100
4 or 5		150
6 to 10		200

* If one of the floors exceeds 20 feet in height the next higher speed is desirable.

† Higher speeds available when needed.

Types of Elevator Control

A. CONTROL SYSTEMS

Standard freight elevator control systems are designed primarily for use with three phase, sixty cycle alternating current at 208, 220 or 440 volts. Provision can be made, however, for operation at other voltages and frequencies.

The elevator driving motor may be either of the variable voltage, direct current type or the alternating current, rheostatic type. The type chosen depends on the service requirements of the installation.

NOTE: For a description of Variable Voltage Equipment and Rheostatic Equipment, refer to Section 2, Page 5 and 6, paragraph B., 1 and 2.

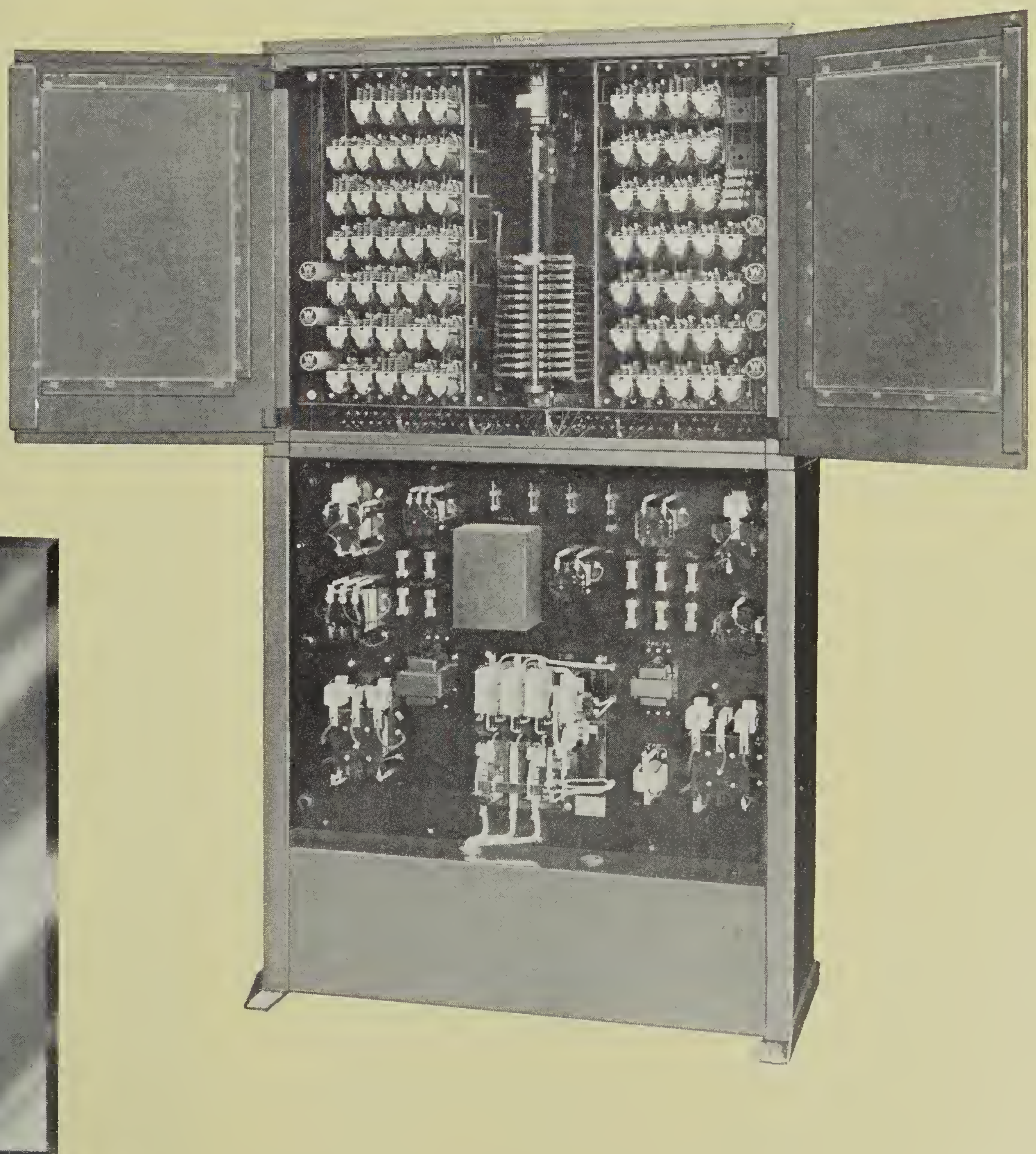


Figure 25. Selective Collective Equipment

TARGET TYPE

FLASHLIGHT TYPE

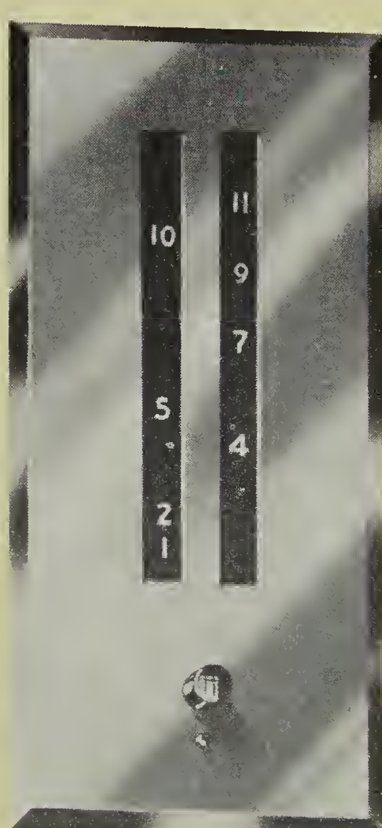


Figure 26. Annunciators

B. METHODS OF OPERATION

*1. **Selective Collective Control*** *(figure 25).* The most useful and flexible control for use with either Variable Voltage or A-C Rheostatic freight elevators and without an attendant is Selective Collective whereby the elevator will pick up a series of calls automatically. For use with an attendant a key operated switch is provided in the car together with a Flashlight Annunciator *(figure 26).* With this arrangement, the attendant has complete control of the car and can answer calls indicated on the annunciator by pressing the corresponding car button. If an attendant is not to be used the annunciator feature may be omitted. When the car is full, or when handling one-piece loads, the freight handler may by-pass other calls by pressing the by-pass button in the car station.

2. Single Automatic Control. A more simple control, the "Single Automatic", is also available for both Variable Voltage and A-C Rheostatic freight elevators for operation without an attendant. With this type of control, a car or corridor call can only be registered when the car is idle. However, a car call has preference over a corridor call. Single Automatic Control will not collect a series of calls as is accomplished with Selective Collective Control. For attendant operation, a single row Flashlight Annunciator in the car will be furnished.

3. Car Switch Self Leveling Control *(figure 27).* If an attendant is always to operate the elevator, the Car Switch Self Leveling Control is a simple

CAR STATION

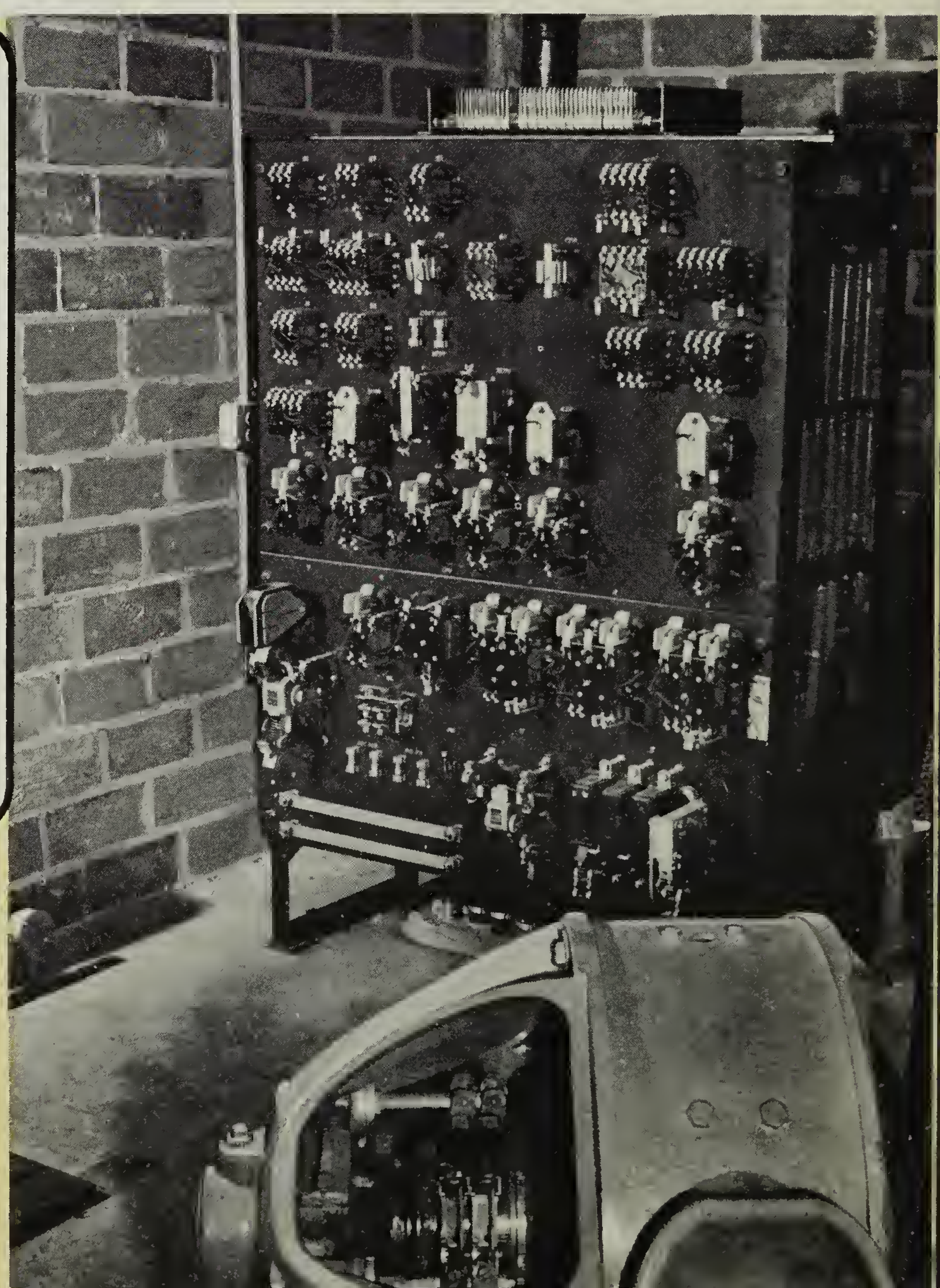
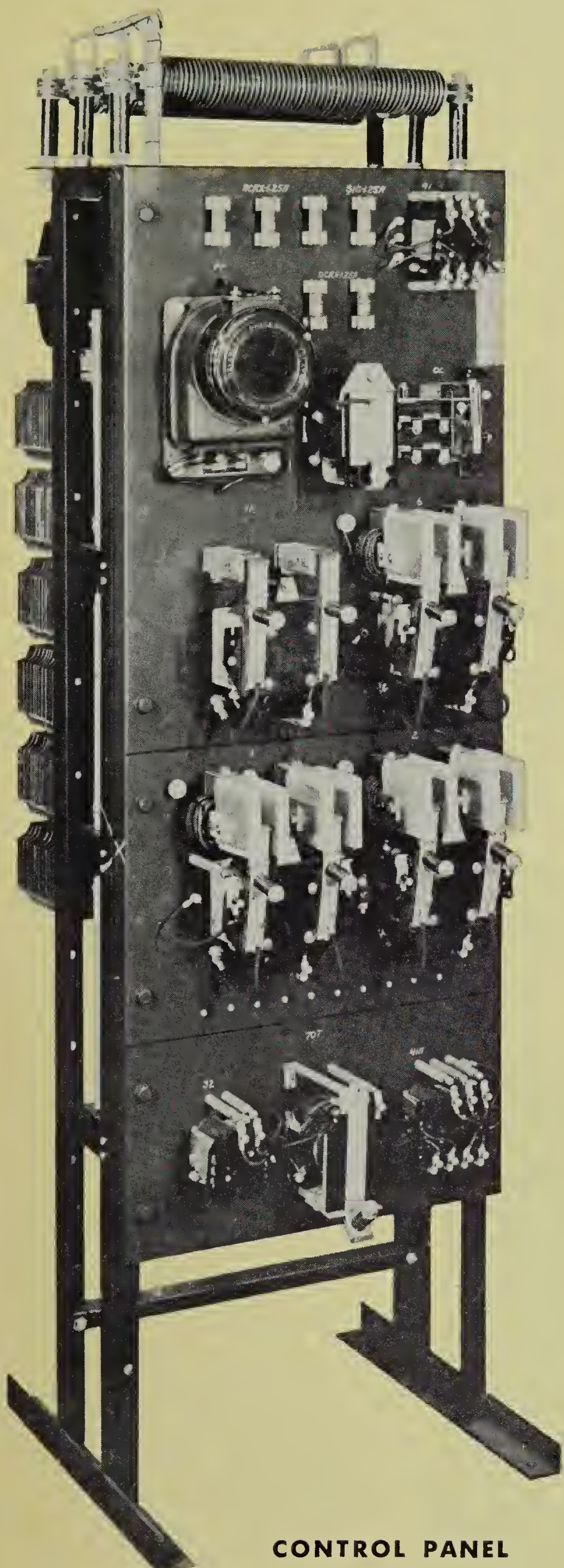


Figure 27. Car Switch Self Leveling Equipment



CONTROL PANEL

Figure 28. Continuous Pressure Equipment

inexpensive means of operating freight elevators having Variable Voltage Control. The car will travel in either direction and will stop in response to the movement of the car switch, leveling automatically at each floor stop. A double row target type annunciator *(figure 26)* to register corridor calls is usually an adequate signal system.

4. Car Switch Control. Car Switch Control may be used for freight elevators with A-C Rheostatic control. Leveling the car at each landing is done by the attendant. A single row target type annunciator is the usual signal system.

5. Continuous Pressure Control *(figure 28).* The least expensive control available for light service A-C Rheostatic elevators, is the Continuous Pressure Control. Buttons are installed in the corridor and car, and move the car in a selected direction as long as the button is held in. The car will stop when the button is released.

> **NOTE:** This control is not recommended for over 70 feet of travel.

CAR STATION

Method of Door Operation

A. POWER OPERATED HOISTWAY DOORS

Generally the doors of all active elevators should be power operated.

All doors particularly wider than eight feet should be power operated, except for inactive elevators.

> **NOTE:** Power operated doors materially improve the efficiency of attendants by reducing fatigue.

B. CAR ENTRANCE

Each entrance of a freight elevator car should be protected with a vertical rise counterbalanced gate. Expanded metal on a rigid iron frame is usually employed. *(Figure 29.)*

Gate operation may be manual or power operated to correspond with the hoistway door operation.

C. OPERATION

On automatic operation a control circuit is set up causing both the car gate and the hoistway door to open as the car levels to a floor.

On car switch operation the car gate and hoistway door are opened by pressure of the door "open" button when the car is in the leveling zone.

The closing of the gate and door is actuated by a push button in the car and for automatic operation; also by a push button at each landing. Release of pressure on the button before the gate and door are fully closed will cause them to reopen.

The electric contact on the car gate and the interlocks on the hoistway doors will prevent movement of the car unless the car gate is closed and the hoistway doors are closed and locked.

Operation of the car gate and each set of hoistway doors may be individually adjusted.

Figure 29.
Car Entrance Gate

Layouts

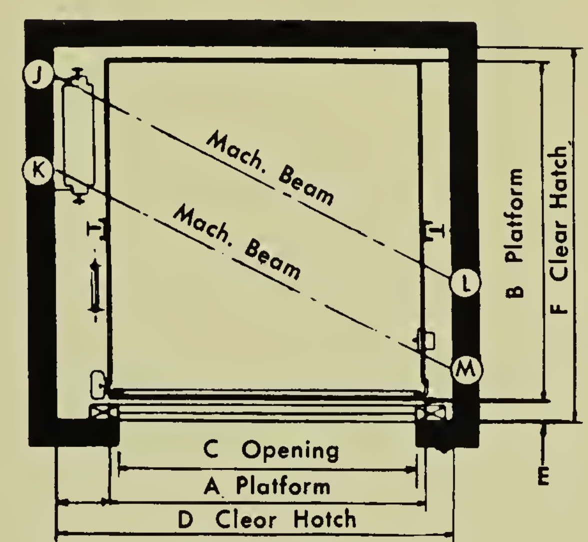
A. LAYOUTS

Layouts for standard freight elevators are given in figures 30 and 31.

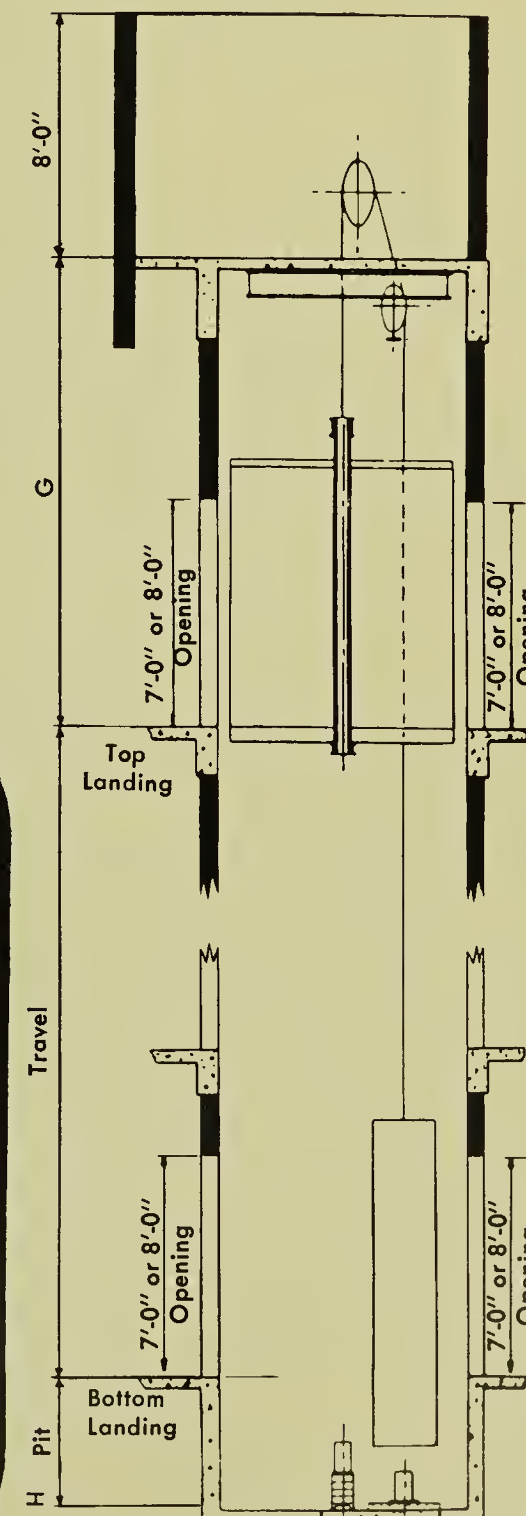
Figure 30 is applicable to capacities from 3000 to 4000 pounds, speeds from 50 to 200 feet per minute, and to a 1:1 roping ratio.

Figure 31 is applicable to capacities from 4000 to 10,000 pounds, speeds from 50 to 200 feet per minute, and to a 2:1 roping ratio.

GEARED FREIGHT—1:1 ROPING CAPACITY—3,000 AND 4,000 LBS. CAR SPEED—50 TO 200 FPM



FRONT OPENING PLAN



ELEVATION

CAPACITY IN LBS.	SPEED F.P.M.	DIMENSIONS A	B	C	D	E	F	G	H	OVERHEAD LOAD IN POUNDS J	K	L	M
3000	50	5'-4"	7'-0"	5'-0"	7'-3"	5"	7'-10"	15'-6"	4'-6"	6,650	8,900	5,900	4,900
	100	6'-4"	8'-0"	6'-0"	8'-3"		8'-10"	16'-0"		7,300	9,200	6,100	5,450
4000	200	6'-4"	5'-0"	6'-0"	8'-5"	5"	5'-10"	16'-4"	5'-3"	10,850	14,150	9,450	7,800
		8'-4"	10'-0"	8'-0"	10'-5"		10'-10"			12,500	15,150	10,350	9,300

Clear Hatch (F dimension) is adequate to permit the installation of both front and rear openings.

Frame opening should be 3" greater than the 7'-0" or 8'-0" clear opening.

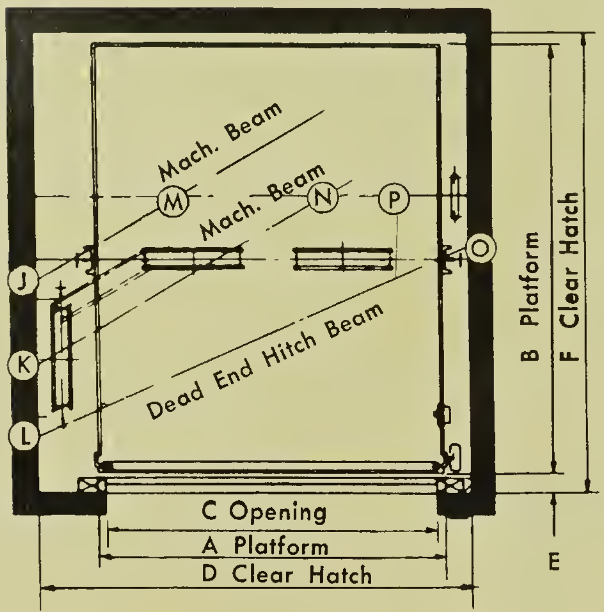
NOTE: The dimensions given in these layouts are based on National Elevator Manufacturing Industry (N.E.M.I.) Standards, as noted. For special conditions, consult your nearest Westinghouse Elevator Division office listed on back page.

Figure 30. Layout for 3000 to 4000 Pound Capacity, Geared Freight Elevators

GEARED FREIGHT—2:1 ROPING

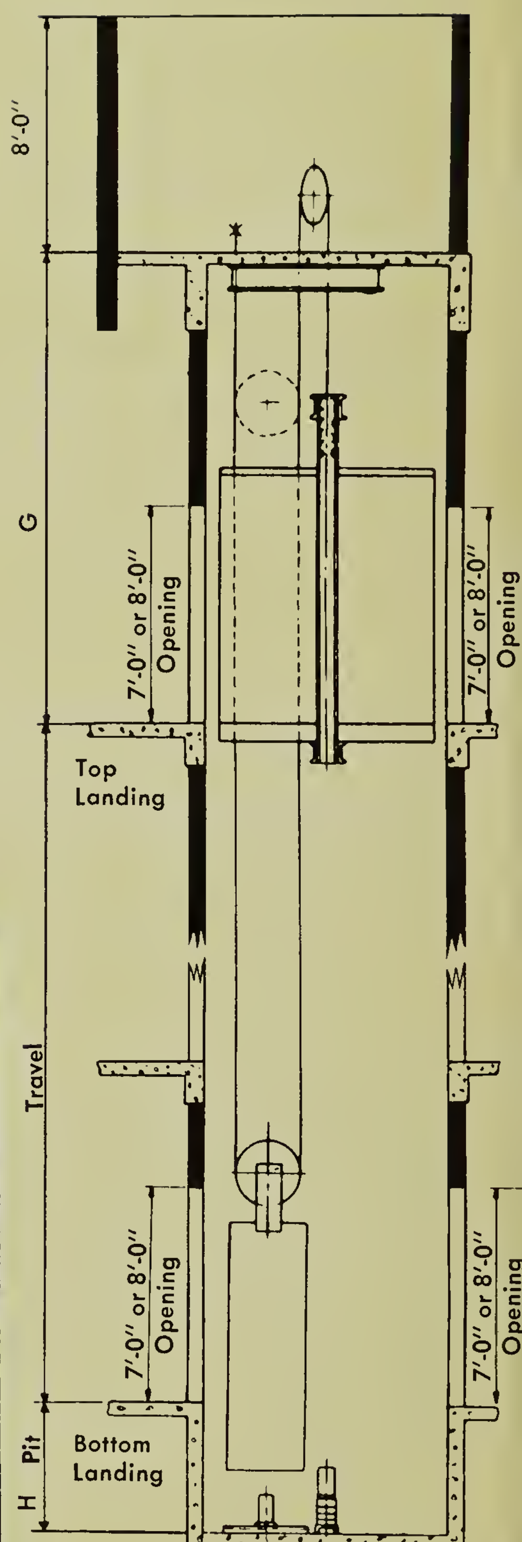
CAPACITY—4,000 TO 10,000 LBS.

CAR SPEED—50 TO 200 FPM



FRONT OPENING

PLAN



ELEVATION

CAPACITY IN LBS.	SPEED F.P.M.	DIMENSIONS A	B	C	D	E	F	G	H	OVERHEAD LOAD IN POUNDS J	K	L	M	N	O	P
4000	75 100	6′-4″	8′-0″	6′-0″	8′-5″	5″	8′-10″	16′-0″	4′-6″	5,400 6,500	8,650 10,250	5,500 6,100	3,900 3,900	4,500 4,050	6,200 6,150	3,150 4,300
5000	75 100	8′-4″	10′-0″	8′-0″	10′-5″	5″	10′-10″	16′-1″	4′-9″	6,600 6,900	11,000 11,350	6,700 6,950	4,900 5,100	4,800 5,500	7,050 7,550	4,850 5,050
5000	200	8′-4″	10′-0″	8′-0″	10′-5″	5″	10′-10″	16′-4″	5′-3″	7,400	14,250	7,300	6,250	5,300	8,000	5,250
6000	50	8′-4″	10′-0″ 12′-0″	8′-0″	10′-5″	5″	10′-10″ 12′-10″	15′-10″	4′-9″	7,000 7,250	11,550 11,650	7,100 7,150	5,150 5,400	5,100 5,700	7,500 7,600	5,250 5,400
6000	75 100	8′-4″	10′-0″ 12′-0″	8′-0″	10′-5″	5″	10′-10″ 12′-10″	16′-1″ 16′-3″	4′-9″	6,750 7,050	12,900 13,150	6,650 6,700	5,700 5,900	10,400 10,600	7,300 8,300	0 0
6000	200	8′-4″	10′-0″ 12′-0″	8′-0″	10′-5″	5″	10′-10″ 12′-10″	16′-4″	5′-3″	7,850 8,100	14,700 15,050	7,850 7,800	6,450 6,700	5,650 11,950	8,350 9,400	5,600 0
8000	50 100	8′-4″	10′-0″ 12′-0″	8′-0″	10′-10″	5″	10′-10″ 12′-10″	16′-6″	5′-6″	8,050 8,350	14,650 15,200	7,300 7,500	7,250 7,500	7,450 7,700	8,650 9,000	7,300 7,500
8000	200	8′-4″	10′-0″ 12′-0″	8′-0″	10′-10″	5″	10′-10″ 12′-10″	16′-8″	5′-6″	9,900 10,200	19,450 20,150	8,400 8,700	8,200 8,500	16,400 17,000	7,750 8,000	0 0
10,000	75	8′-4″ 10′-4″	12′-0″ 14′-0″	8′-0″ 10′-0″	10′-11″ 12′-11″	5″	12′-10″ 14′-10″	16′-10″	5′-6″	10,200 11,400	15,310 17,350	9,760 10,850	7,800 8,000	8,900 9,200	11,000 11,200	8,350 9,400
10,000	150	8′-4″ 10′-4″	12′-0″ 14′-0″	8 -0″ 10′-0″	10′-11″ 12′-11″	5″	12′-10″ 14′-10″	17′-1″	6′-0″	10,600 12,500	20,950 21,000	9,050 12,400	8,800 11,050	17,700 11,900	8,300 12,500	0 11,500

Clear Hatch (F dimension) is adequate to permit the installation of both front and rear openings.

Frame opening should be 3" greater than the 7'-0" or 8'-0" clear opening.

NOTE: The dimensions given in these layouts are based on National Elevator Manufacturing Industry (N.E.M.I.) Standards, as noted. For special conditions, consult your nearest Westinghouse Elevator Division office listed on back page.

Figure 31. Layout for 4000 to 10,000 Pound Capacity, Geared Freight Elevators

Freight Elevator Application Examples

A. GENERAL

The foregoing sections have discussed the factors that must be known in the application of standard freight elevators.

The following explanations and examples of actual applications will serve as guides in the use of the information.

B. HOURLY CARRYING CAPACITY

The carrying capacity per hour of a freight elevator is determined by the normal load of the elevator and the time required per round trip. The Round Trip time is made up of the following four elements, as indicated on Curve I, page 32.

a. *Running Time.* This is equal to the distance travelled divided by the car speed chosen.

b. *Accelerating and Retarding Time.* This consists of the *additional* time required to accelerate and retard the car for each stop.

c. *Door Time.* Door time is the time required to open and close the car gate and hoistway doors, for each stop.

d. *Loading Time.* This is the time required to load and unload the car and *varies greatly* with the type of material to be handled and the method of horizontal material handling used.

> **NOTE:** It is recommended that whenever practical a study be made of the loading and unloading operations of a similar elevator in the plant.
>
> After computing the round trip time for a freight elevator application, it is advisable to add 20% to the calculated round trip time to allow for waiting time between loads and other delays.

EXAMPLE 1

assume:

TOTAL TONNAGE TO BE HANDLED PER DAY..............................650
ELEVATOR CAPACITY..10,000 lb.
CAR SPEED..100 fpm
CONTROL..........................Variable Voltage and Self Leveling
DOORS..Power operated
MATERIAL..............Palletized; each pallet weighing 2800 lb.
PLATFORM SIZE..............................To accommodate 3 pallets
NO. OF FLOORS..3
FLOOR HEIGHT....................17 ft. Total travel 34 feet one way
LOADING BY POWER TRUCK

The elevator will normally travel a distance of 34 feet on each trip, making a stop at the 2nd floor in the down direction only for loading and unloading.

calculations: Refer to Curve I, page 32.

RUNNING TIME:
TRAVEL = 2 x 34 feet = 68 feet
RUNNING TIME = 41 seconds 41
ACCELERATING AND RETARDING TIME =
3 stops x 1 ¾ = 5 ¼ seconds...5 ¼
DOOR TIME = 3 stops x 8 = 24 seconds.....................................24
LOADING TIME = 3 stops x 15 = 45 seconds................................45
TOTAL ....115 ¼
Add 20% for loading delays, etc.......................23
TOTAL ROUND TRIP TIME =..............................138 ¼
Use.........................*138* sec.

TRIPS PER HOUR (3600 seconds) $= \frac{3600}{138} =$ 26

SINGLE CAPACITY LOAD = 3 x 2800 lb. =....................8400 lb.
CAPACITY PER HOUR = 8400 x 26 =.......................218,400 lb.

650 tons can be handled in approximately six hours.

In the above calculations the item that requires the greatest study of actual conditions is the loading time. It is obvious that this will vary over wide limits depending upon the number of power trucks used, the distance from which the material must be brought and the method of loading employed. Where there is a continuous flow of material very satisfactory results can be obtained with two elevators, so that as one elevator is being loaded the other is being unloaded.

NOTE: If local studies of loading and unloading on a similar elevator determine more closely the loading time, such figures should be used in preference to those given in Curve I.

EXAMPLE 2

building characteristics:

FLOOR HEIGHTS

FLOOR	FEET
1 to 2	18
2 to 3	16
3 to 4	16
4 to 5	16
TOTAL TRAVEL	66

material to be handled:

1. 300,000 pounds in and out of building per day.
2. 225,000 pounds between 1st and 4th floors on power trucks. The power truck is 6 feet long by 4 feet wide, weighing 3500 pounds empty and 6500 pounds loaded.
3. 75,000 pounds in and out between 1st and various floors by hand truck and package.

calculations:

CAPACITY AND SIZE

The capacity of the elevator is dependent upon the weight of the loaded power truck. A 6000 pound rating could be used if the truck remains on the floor, but it provides no reserve. (See Section 3, page 16, Table 1.) By referring to this table of standard car sizes the 8′4″ x 10′0″ size 8000 pound rating would be selected.

TYPE OF EQUIPMENT

The leveling type of equipment is desirable for this application because the releveling feature will assure accurate landing at the floors to facilitate moving the 3½ ton power truck on and off the car. It is also evident that the weight of material to be moved per day will cause this elevator to be active and for this reason variable voltage equipment should be considered first.

DOOR OPERATION

Because this elevator will evidently be reasonably active, power operated doors are desirable.

SPEED SELECTION

(See Section 4, page 20, Table 3.) 150 feet per minute is the recommended speed for five floors (66 feet travel) with variable voltage equipment.

Refer to the Application Curve I, page 32, and calculate the time as follows:

For ¾ of service between 1st and 4th floors:

if power truck travels on elevator with load

RUNNING TIME (from 150 FPM curve, 50 feet travel)	20	sec.
ACCELERATION AND RETARDATION (from note)	1 ¾	sec.
DOOR OPERATION (from note)	8	sec.
LOADING AND UNLOADING (from note)	15	sec.
TOTAL TIME ONE WAY	44 ¾	sec.
Use	45	sec.
ROUND TRIP TIME 2 x 45 = 90 seconds plus 20% =	108	sec.

$$\frac{225{,}000 \text{ lbs. (1st to 4th floor)}}{3000 \text{ lbs. per trip}} = \ldots\ \mathbf{75} \text{ trips}$$

75 trips x 108 seconds = 2 hours 15 minutes

For ¾ of service between 1st and 4th floors:

if power truck remains on floor—assuming it loads 2 skids or pallets per trip

RUNNING TIME (from 150 FPM curve, 50 feet travel)	20	sec.
ACCELERATION AND RETARDATION (from note)	1 ¾	sec.
DOOR OPERATION (from note)	8	sec.
LOADING AND UNLOADING	90*	sec.
TOTAL TIME ONE WAY	119 ¾	sec.
Use	120	sec.
ROUND TRIP TIME 2 x 120 = 240 sec. plus 20% =	288	sec.

$$\frac{225{,}000 \text{ lbs. (1st to 4th floor)}}{6000 \text{ lbs. per trip}} = \ldots\ \mathbf{38} \text{ trips}$$

38 trips x 288 seconds = 3 hours 3 minutes

**Varies widely. Depends on how far truck must travel to pick up loads.*

The balance of the service consists of moving 75,000 pounds between 1st and various floors by hand truck and package. Assume an average load of 1500 pounds; average travel 1st to 3rd floor, 34 feet; and an average of 3 stops per round trip.

RUNNING TIME (150 FPM, 34 feet travel)	14	sec.
ACCELERATION AND RETARDATION (average)	2 ⅝	sec.
DOOR OPERATION (average)	12	sec.
LOADING AND UNLOADING (2 hand trucks)	50	sec.
TOTAL TIME ONE WAY	78 ⅝	sec.
Use	80	sec.
ROUND TRIP TIME 2 x 80 = 160 sec. plus 20% =	192	sec.

$$\frac{75{,}000 \text{ lbs. (1st to 3rd floor) (Average)}}{1500 \text{ lbs. per trip}} = \ldots\ \mathbf{50} \text{ trips}$$

50 trips x 192 seconds = 2 hours 40 minutes

Total time to move 300,000 pounds in and out of building is:
(If power truck travels on elevator with load)

2 hours 15 minutes plus 2 hours 40 minutes = 4 hours 55 minutes

If power truck remains on floor

3 hours 3 minutes plus 2 hours 40 minutes = 5 hours 43 minutes

No allowance has been made for trips with only one package. Twenty such trips would add approximately one hour to the time elevator is in operation.

CONTROL REQUIREMENT

The activity of the elevator and the number of floors served make selective collective operation the most desirable.

EXAMPLE 3

building characteristics:

FLOOR HEIGHTS

FLOOR	FEET
1 to 2	18
2 to 3	16
TOTAL TRAVEL	34

material to be handled:

1. 10 tons in and out of building per day.
2. The material is miscellaneous freight, some to be moved in hand trucks and some in package form.
3. Hand truck size is 4½ ft. long by 2½ ft. wide; truck weight 250 lbs., load weight 750 lbs.

deduction:

20,000 lbs. in and out of building per day (8 hrs.)

calculations:

CAPACITY AND SIZE

By referring to the table on standard car sizes the 6′4″ x 8′0″ car would be chosen. (See Section 3, page 16, Table 1.) This will accommodate two hand trucks per trip or will provide 45 square feet for loads of miscellaneous packages. A 2500 lb. capacity elevator would be adequate for the present, but 3000 lb. capacity would be preferable to allow for possible greater loads in the future.

TYPE OF EQUIPMENT

It is evident that this elevator will not be very active and AC Rheostatic equipment will be considered first.

DOOR OPERATION

Because this elevator will not be very active, manually operated doors will be chosen.

CONTROL REQUIREMENT

Single Automatic control will be satisfactory for this elevator.

SPEED SELECTION

75 feet per minute is the recommended speed for three floors.

For service from 1st to 3rd floor without an intermediate stop, refer to Application Curve I, page 32, and calculate the time as follows:

RUNNING TIME (from 75 FPM curve, 34 feet travel)	27	sec.
ACCELERATION AND RETARDATION (from note)	2 ¼	sec.
DOOR OPERATION (from note)	16	sec.
LOADING AND UNLOADING (from note, 2 trucks)	50	sec.
TOTAL TIME ONE WAY	95 ¼	sec.
		or
	95	sec.
ROUND TRIP TIME 2 x 95 = 190 seconds plus 20% =	228	sec.
20,000 lbs. per day (all hand trucks) / 1500 lbs. per trip (2 truck loads) =	**13**	trips

13 trips x 228 seconds = 50 minutes

The following possible condition should also be calculated: On one day only five trips are made with one hand truck per trip and the balance of the day's activity consists of package loads at 500 lbs. per trip. Trips 1st to 3rd floors with a stop at the 2nd floor going one way.

HAND TRUCK PORTION:

RUNNING TIME (from 75 FPM curve, 34 feet travel)	27	sec.
***ACCELERATION AND RETARDATION** (from note 1 ½)	3 ⅜	sec.
***DOOR OPERATION** (from note 1 ½)	24	sec.
LOADING AND UNLOADING (from note)	50	sec.
TOTAL TIME ONE WAY	104 ⅜	sec.
		or
	104	sec.
ROUND TRIP TIME 2 x 104 = 208 seconds plus 20% =	250	sec.

**Multiplied by 1 ½ for one way stop at 2nd floor.*

5 round trips x 250 seconds = 20 minutes

PACKAGE PORTION:

RUNNING TIME (from 75 FPM curve, 34 feet travel)	27	sec.
***ACCELERATION AND RETARDATION** (from note 1 ½)	3 ⅜	sec.
***DOOR OPERATION** (from note 1 ½)	24	sec.
LOADING AND UNLOADING (package loading may vary greatly depending on weight, size, number of packages and number of persons loading)	120	sec.
TOTAL TIME ONE WAY	174 ⅜	sec.
		or
	175	sec.
ROUND TRIP TIME 2 x 175 = 350 seconds plus 20% =	420	sec.
16,250 lbs. of package loads / 500 lbs. per trip =	**33**	trips

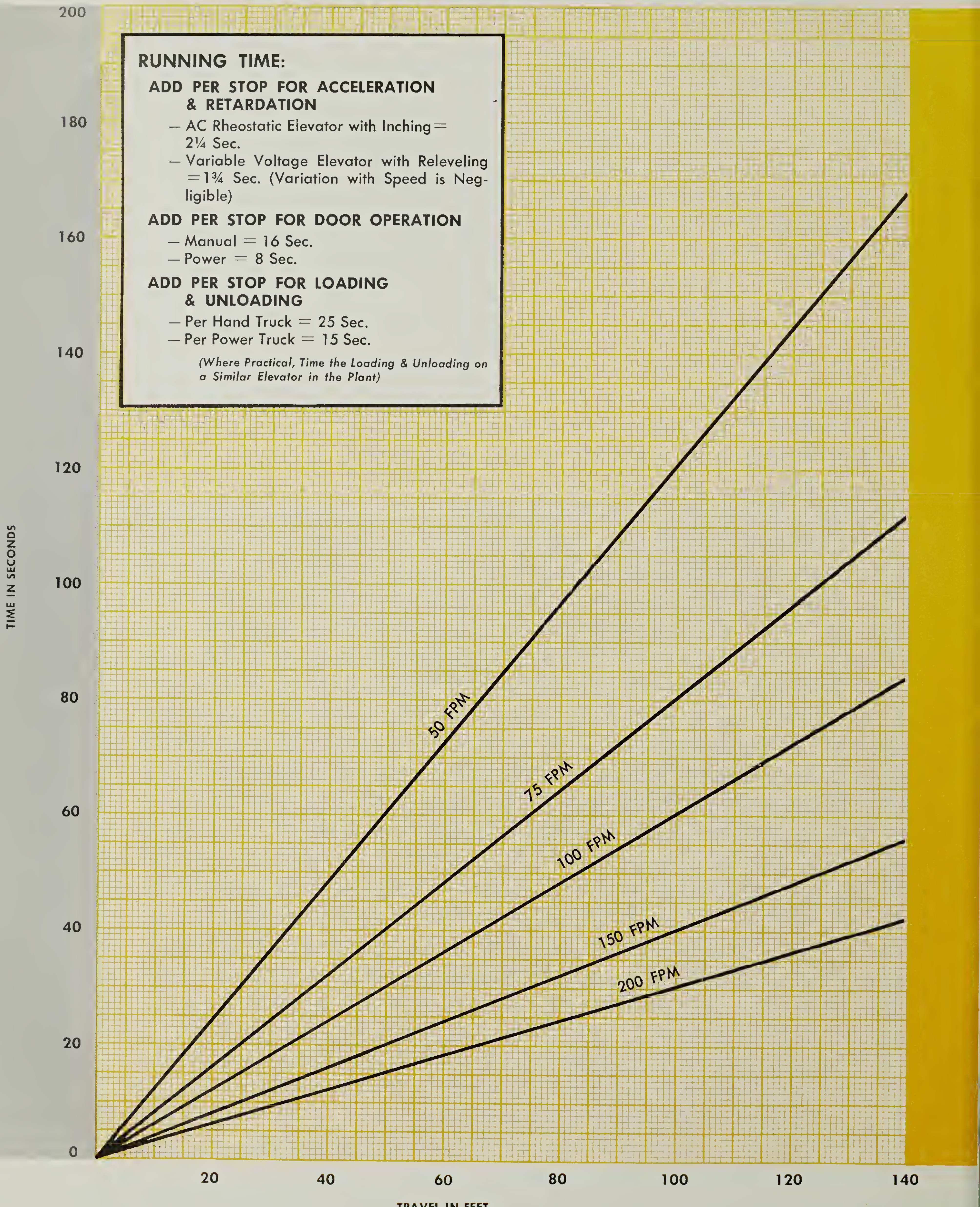
33 trips x 420 seconds = 3 hours 51 minutes
Add time for truck trips = 50 minutes

**Multiplied by 1 ½ for one way stop at 2nd floor.*

Total time = 4 hours 41 minutes

NOTE: *From the above calculations it appears that this elevator will be active about half a day or less for the service presently contemplated.*

FREIGHT ELEVATOR APPLICATION CURVE I



Curve I

Budget Price Data

A. GENERAL

NOTE: Prices given in this section are for use only as a guide in preparing a budget and should not be regarded as an actual price quotation.

In selecting a freight elevator for a particular installation, one of the considerations is the amount of investment involved.

The basic information for calculating budget figures for the standard freight elevator equipment discussed in this Guide is presented in Curve 2, this section, page 35. Curve 2 gives budget prices on an installed basis for standard freight elevators including doors serving two floors, with a 15 foot rise. For each additional floor to be served by the elevator the amounts to be added are indicated.

If Electric Operators are desired for car gate and hoistway doors the cost of the operator must be added to the amounts given in Curve 2. Budget cost, on an installed basis, is as follows:

TABLE 4

	FIRST DOOR	EACH ADDITIONAL DOOR
Electric Operator Front Opening	$2500	$600
Electric Operator Rear Opening	$2300	$600

PRICE ESTIMATES

EXAMPLE 1

Following is an estimate of initial investment for a freight elevator with specifications as indicated:

Capacity	6000 pounds	Number of floors to be served	5
Speed	150 FPM	Front Openings	5
Car Size	8′-4″ x 10′-0″	Rear Openings	2
Control	2BC-VV	Door Operation	Power

From Curve A (Curve 2, page 35) for 2 floors	$23,400
From note, Curve 2, for Selective Collective (2BC) operation	800
From note, Curve 2, for 3 additional floors ($1650 x 3)	4,950
From note, Curve 2, for 1 rear opening	1,250
From note, Curve 2, for 1 additional rear opening	850
From table 4 for first front Electric Operator	2,500
From table 4 for first rear Electric Operator	2,300
From table 4 for 5 additional Electric Operators ($600 x 5)	3,000
Total Budget Price	$39,050

EXAMPLE 2

Determination of the approximate price of example one, Section 8, page 27, may be made by referring to Curve B of Curve 2, page 35 and table 4, page 33, as follows:

Elevator—10,000 lbs. at 100 FPM, 2 floors	$26,900
For Selective Collective (2BC)	800
For 1 additional floor	1,650
For Electric Operator, first front opening	2,500
For Electric Operator, 2 additional front openings ($600 x 2)	1,200
Total estimated installed price for elevator and electric operators	$33,050

EXAMPLE 3

Determination of the approximate price of example two, Section 8, page 28, may be made by referring to Curve A of Curve 2, page 35 and to table 4, page 33, as follows:

Elevator—8,000 lbs. at 150 FPM, 2 floors	$26,900
For Selective Collective (2BC)	800
(Price will be accurate enough for making comparison of equipment without adjusting for 6 foot additional travel)	
For 3 additional floors ($1650 x 3)	4,950
For Electric Operators, front opening	2,500
For Electric Operators, 4 additional front openings ($600 x 4)	2,400
Total estimated installed price for elevator and electric operators	$37,550

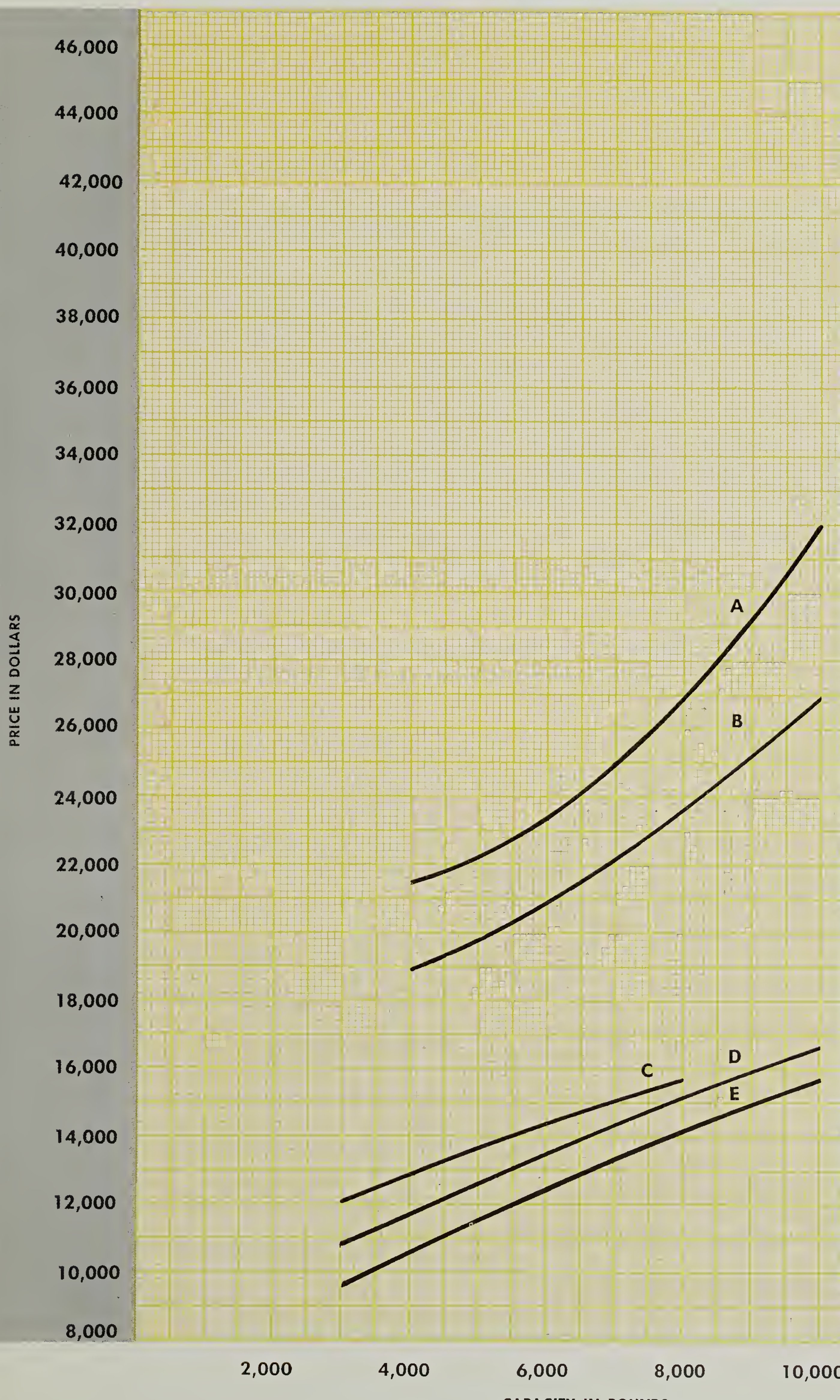
EXAMPLE 4

Determination of the approximate price of example three, Section 8, page 30, may be made by referring to Curve D of Curve 2, page 35 and to table 4, page 33, as follows:

Elevator—3,000 lbs. at 75 FPM, 2 floors	$10,800
For Single Automatic Operation (PB)	400
For 1 additional floor	1,400
(Price is accurate enough for making comparison of equipment without adjusting for additional 4 foot travel)	
Total estimated installed price for elevator and manually operated doors	$12,600

APPROXIMATE INSTALLATION PRICE

CURVE A & B—VARIABLE VOLTAGE
CURVES C, D & E—AC RHEOSTATIC



CURVE A: (Variable Voltage)
2 floors (15 ft. rise), 150 FPM speed, 8′-4″ x 10′-0″ car size for all capacities. Operation is Single Automatic (PB).

CURVE B: (Variable Voltage)
2 floors (15 ft. rise), 100 FPM speed, 8′-4″ x 10′-0″ car size for all capacities. Operation is Single Automatic (PB).

Optional with A or B
- To price for Single Automatic (PB) add $800 for Selective Collective Operation (2BC).
- For additional floors add $1600 per floor for Single Automatic Operation (PB) and $1650 per floor for Selective Collective Operation (2BC).
- For the first rear opening add $1250 and $850 for each additional rear opening.

CURVE C: (AC Rheostatic)
2 floors (15 ft. rise), 100 FPM speed, 8′-4″ x 10′-0″ car size for all capacities except 3000# where car is 6′-4″ x 8′-0″. Operation is Constant Pressure (CB).

CURVE D: (AC Rheostatic)
2 floors (15 ft. rise), 75 FPM speed, 8′-4″ x 10′-0″ car size for all capacities except 3000# where car is 6′-4″ x 8′-0″. Operation is Constant Pressure (CB).

CURVE E: (AC Rheostatic)
2 floors (15 ft. rise), 50 FPM speed, 8′-4″ x 10′-0″ car size for all capacities except 3000# where car is 6′-4″ x 8′-0″. Operation is Constant Pressure (CB).

Optional with C & D or E
- To the price for Constant Pressure (CB) add $400 for Single Automatic operation (PB) and $1100 for Selective Collective operation (2BC). Add $1800 if Automatic Releveling (in lieu of inching) is desired with Single Automatic (PB) or Selective Collective (2BC) operation.
- For each additional floor add $1300 for CB, $1400 for PB and $1450 for 2BC operation.
- For the first rear opening add $1250 and $850 for each additional rear opening.

Curve 2 Freight Elevator Price Curve

Typical and Special Installations

Figure 32. Scandore Paper Box Co., Brooklyn, N. Y.
5000 lbs.—100 fpm

A. TYPICAL INSTALLATIONS

Typical Westinghouse freight elevator installations are shown in figures 32 to 41 inclusive.

These illustrations are indicative of the wide range of applications which Westinghouse freight elevators have in all types of buildings.

The capacity, speed and operation of each installation are indicated under the figures. The following symbols are used for the various types of operating systems:

2 B C	—2 Button Selective Collective
C S	—Car Switch
C A L	—Car Switch (Automatic floor stop)
C S V C L	—Car Switch Self Leveling
P B	—Single Automatic
P B R L	—Single Automatic—Releveling
C B	—Continuous Pressure

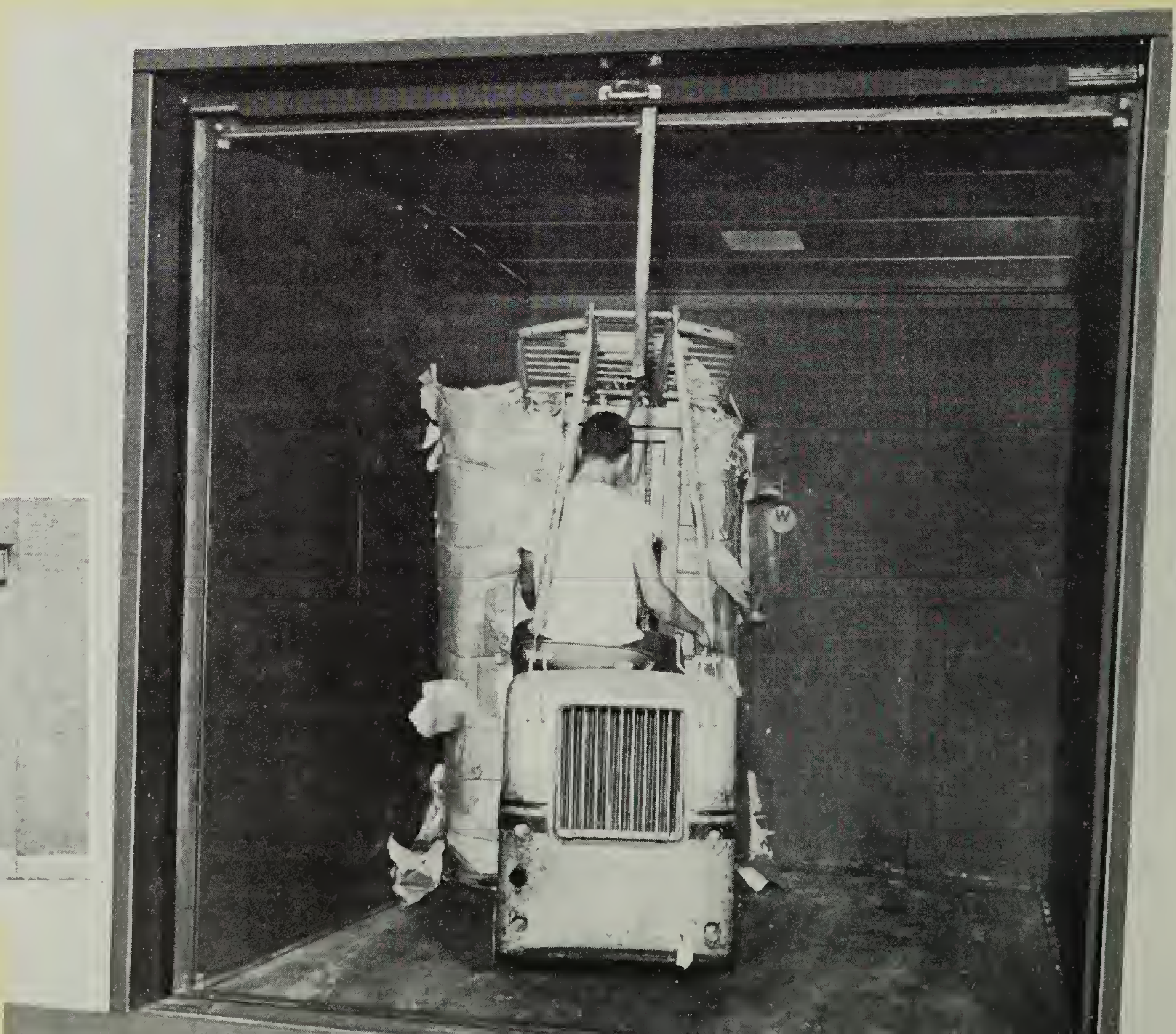
Figure 33. Century Electric Co., St. Louis, Missouri
8000 lbs.—200 fpm

Figure 34. J. C. Penney Store, Seattle, Washington • 8000 lbs.—200 fpm

Figure 35. Macy's Department Store, Flatbush, N. Y. • 8000 lbs.—100 fpm

Figure 36. Kelley-How-Thompson Co., Duluth, Minn. • *6000 lbs.—150 fpm*

Figure 37.
Great Eastern Packing & Paper Stock Co.,
Boston, Mass.
10,000 lbs.—75 fpm



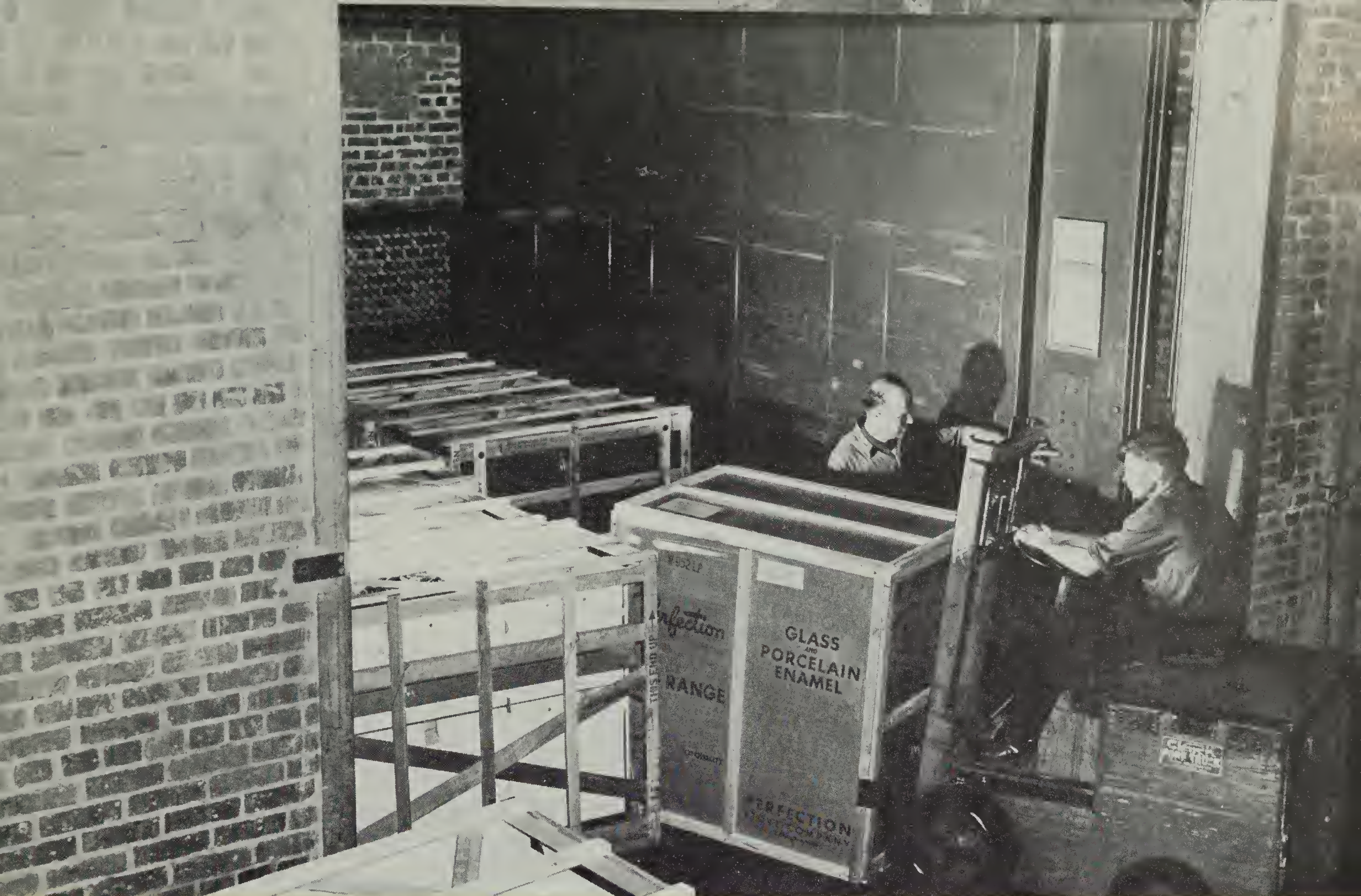


Figure 38. Perfection Stove Co., Cleveland, Ohio • 20,000 lbs.— 200 fpm

Figure 39.
H. L. Green Co., Washington, D. C.
3000 lbs.—50 fpm

Figure 40. Berke Bros. Distilleries, Inc., Boston, Mass. • *4000 lbs.—100 fpm*

Figure 41. Philadelphia Inquirer, Philadelphia, Pa. • *20,000 lbs.—200 fpm*

B. SPECIAL INSTALLATIONS

The information given in this Guide has dealt with standard freight elevators for general use.

In addition to standard equipment, Westinghouse has special equipment to provide greater capacity, higher speed, or other variations from the normal when required for unusual conditions.

Figures 42 to 45 inclusive illustrate special Westinghouse freight elevator installations.

Figure 42. Benjamin Franklin Garage, Philadelphia, Pa. • 6000 lbs.—200 fpm

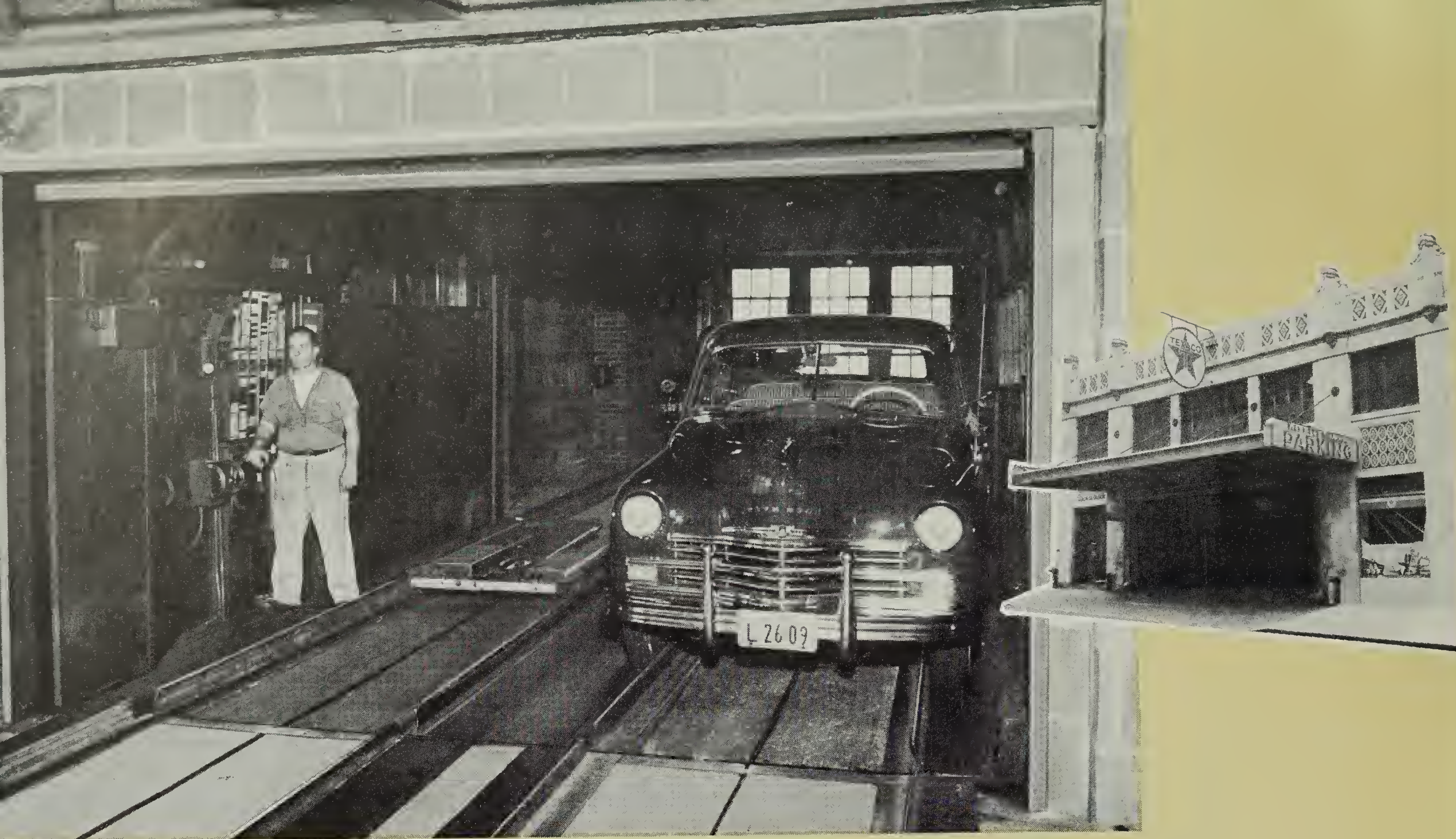
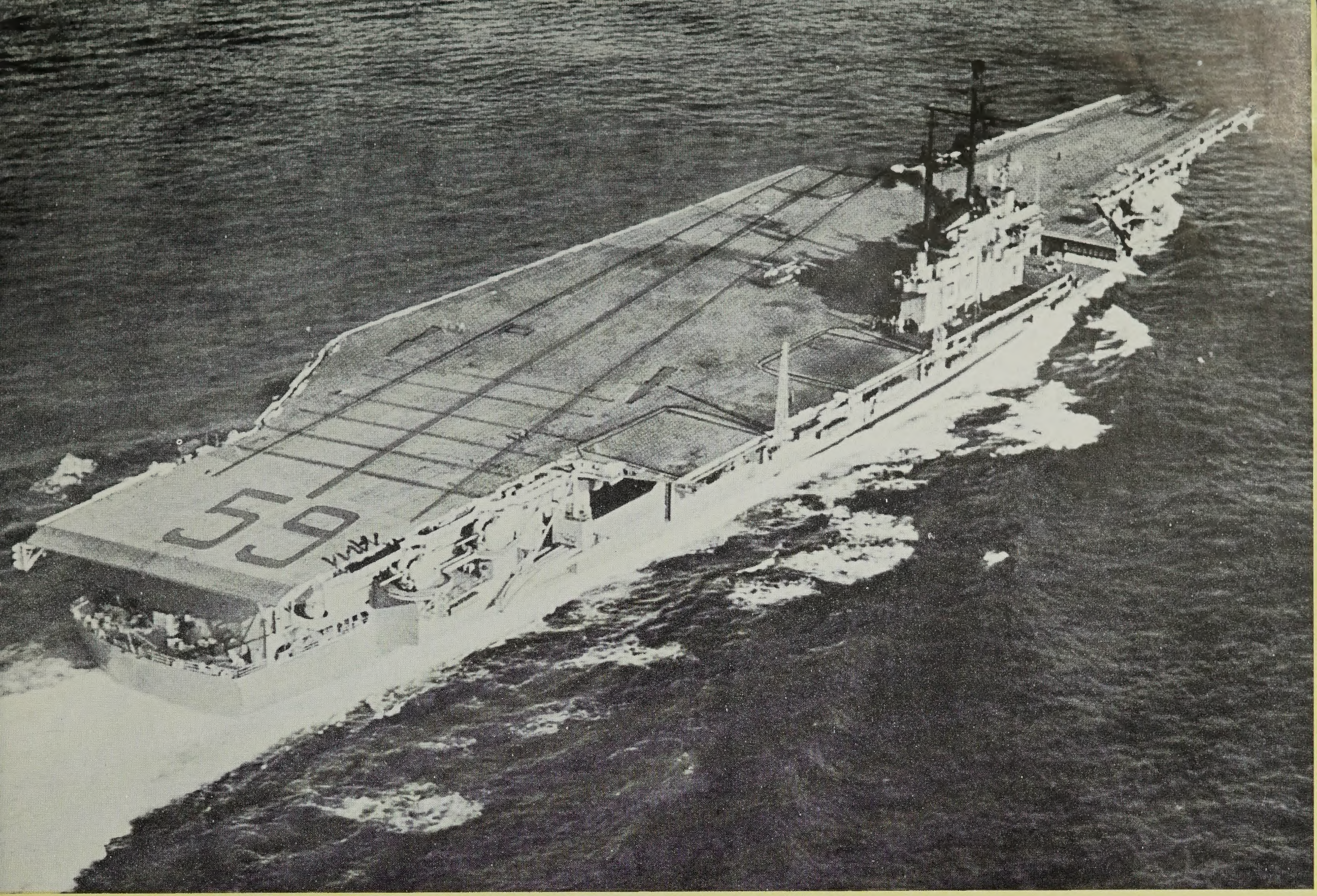


Figure 43. Kent Garage, New York, N. Y. • 10,000 lbs.—450 fpm

Figure 44. Abraham & Straus, Brooklyn, N. Y. • 8000 lbs.—350 fpm • 15,000 lbs.—200 fpm



Official U. S. Navy Photograph

Figure 45. Deck-Edge Elevators on a Navy Carrier.

Westinghouse is particularly proud to have been chosen by the Navy to develop the "Deck-Edge" freight elevator—the most unique installation in the history of elevatoring.

Westinghouse—designed, developed, constructed and installed the deck-edge elevators for the U.S. Navy aircraft carriers such as the USS Forrestal, illustrated above.

As shown, these giant elevators transport airplanes from the hangar deck to the flight deck in a matter of seconds. The USS Forrestal was built by Newport News Shipbuilding and Dry Dock Company.

Protective Maintenance

A Westinghouse Protective Maintenance Agreement will relieve the owner of the responsibilities of vertical transportation problems and worries. Under this contract Westinghouse agrees to take all responsibility for proper operating conditions of the freight elevators. The contract provides for labor, materials, and necessary parts required to insure operating efficiency.

Here are the 10 BIG ADVANTAGES of Westinghouse Protective Maintenance!

1. **Maximum Safety and smooth Operation**
2. **Greater Tenant Satisfaction**
3. **Increased All-Around Economy**
4. **No unexpected large Repair Bills**
5. **Fewer Shut Downs . . . Less Time Out**
6. **24 hour Service at All Times**
7. **Longer Elevator Life**
8. **Greater Elevator Efficiency**
9. **Genuine Westinghouse Parts**
10. **Complete Westinghouse Facilities**

Westinghouse Protective Maintenance is paid for on a monthly basis thus permitting accurate budgeting of all elevator maintenance costs on a predetermined, fixed charge basis. The three-page, clearly worded, easily understood contract covers in detail the responsibilities Westinghouse will assume, the work it will do, and the service the company will give.

Thousands of satisfied building managers throughout the country attest to the value of this maintenance plan. By turning over the safe-keeping of your freight elevators to Westinghouse you are assured of positive protection and trouble-free operation.

ELEVATOR DIVISION

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